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A494 River Dee Bridge Replacement Scheme Environmental Statement

Volume 1: Technical Assessment Report

September 2025 (incorporating August 2026 amendments to Chapters 7 and 16)



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A494 RIVER DEE BRIDGE REPLACEMENT SCHEME

Environmental Statement

Volume 1: Technical Assessment Report

Chapter 1: Introduction

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1. Introduction

1.1 This document

1.1.1 This document is Chapter 1 of the Environmental Statement (ES) for the A494 River Dee Bridge Replacement hereinafter referred to in this document as 'the Scheme'. The ES reports the findings of the Environmental Impact Assessment (EIA) process.

1.1.2 It has been determined that in line with Directive 2011/92/EU as amended by 2014/52/EU for projects under the Highways Act 1980 and the Environmental Impact Assessment (Miscellaneous Amendments Relating to Harbours, Highways and Transport) Regulations 2017 and DMRB LA 102 Screening projects for Environmental Impact Assessment[1], that the A494 River Dee Replacement Scheme is a relevant project and therefore a statutory EIA is required and the results of the assessment reported in this ES.

1.1.3 Also, and in accordance with Regulation 63 of the Conservation of Habitats and Species Regulations 2017 (as amended)[2], an Assessment of implications on European Sites (AIES) has also been prepared to consider the likely significant effects of the Scheme on a European site or a European offshore marine site now referred to as a site within the National Site Network. The findings of the AIES are reported separately in a Habitat Regulations Assessment (HRA) report undertaken in accordance with DMRB LA 115 Habitat Regulations Assessment. The report concludes that it is necessary for an Appropriate Assessment to be undertaken as part of the statutory process for the Scheme.

1.1.4 This Scheme for a replacement bridge has been developed following the Welsh Trunk Road Appraisal Guidance (WelTAG) Stages 0 and 1 Appraisal undertaken in response to current Welsh Government transport policies such as Llwybr Newydd – the Wales Transport strategy that was published 2021.

[1] Available at DMRB LA 102 – Screening projects for EIA Accessed 17/01/2025
[2] As amended by The Conservation of Habitats and Species (Amendment) (EU Exit) Regulations 2019. The Conservation of Habitats and Species (Amendment) (EU Exit) Regulations 2019 (legislation.gov.uk)

1.2 Background

1.2.1 The A494 River Dee Bridge provides a vital connection for cross-border traffic between north Wales, the north-west of England and beyond, connecting people, communities, and businesses. The bridge is a strategic crossing point of the River Dee and was constructed as part of the wider A494 dual carriageway scheme that opened in 1962. The deck of the bridge is now in poor structural condition and in urgent need of replacement for the strategic road network to remain fully open to traffic.

1.2.2 The bridge carries approximately 68,400 vehicles per day.[3] This volume of traffic means that closure of the bridge to replace deteriorated parts would cause severe disruption to the users of the strategic road network, communities and adversely affect the economy in North Wales. The inspections and monitoring to date have concluded that the frequency of repairs and the risk of major repair and intervention requiring the closure of the bridge is growing year-on-year. If nothing is done, the bridge will continue to deteriorate which may require measures such as further weight restrictions and lane closures in the short to medium term and result in closure in the medium to long term.

1.2.3 A new replacement bridge is therefore required and needs to be built ‘off-line’ in order to maintain the high volume of traffic until the replacement bridge and new connections to the existing A494 road corridor are constructed and the existing bridge can be closed and demolished.

[3] Average seven-day daily flow based on 2024 count data.

1.3 Location of the Scheme

1.3.1 The A494 Dee Bridge and road corridor is a strategic crossing point of the River Dee and a major arterial route between the north of England and Wales. The bridge is a vital component of the wider A55, A550 and A494 strategic road network.

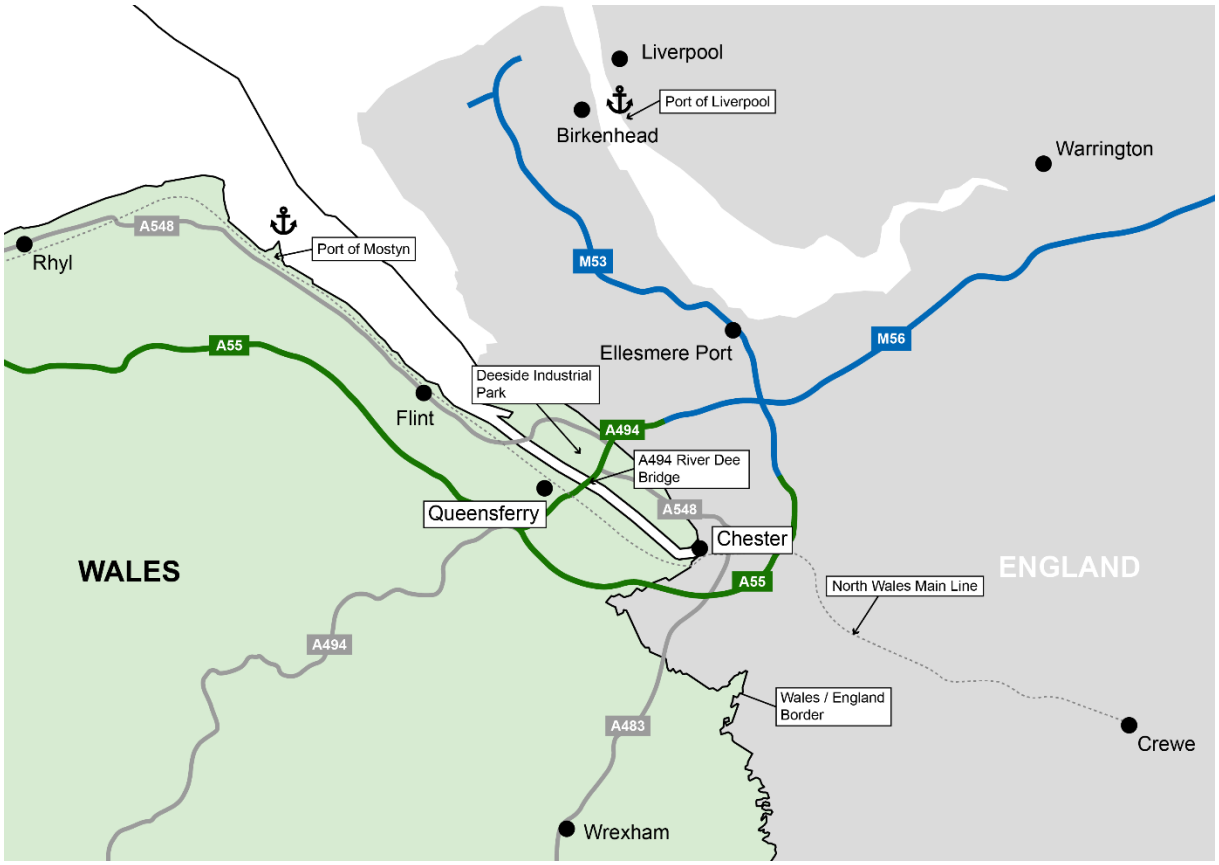
1.3.2 The Dee Bridge is located approximately eight kilometres north-west of Chester where the A494 crosses the canalised section of the River Dee. The River Dee flows in a north-westerly direction beneath the bridge towards the sea at Liverpool Bay and the Point of Ayr Lighthouse approximately twenty-five kilometres downstream. The surrounding landscape is flat and low-lying, being land originally reclaimed from the Dee Estuary.

1.3.3 The area is urban and industrial in nature with the residential area of Queensferry to the south-west and Garden City to the north. The industrial lands of Sandycroft lie to the south-east and Deeside to the north-west. East of the A494 and Dee Bridge and north of the river, the area is predominantly agricultural land.

1.3.4 The North Wales Coast Line (Engineer's Line Reference CNH3) railway, also known as the Chester to Holyhead line, runs parallel with the river Dee and crosses over the A494 road corridor approximately 250 metres south-west of the Dee Bridge. The railway continues on an embankment either side of the A494 road corridor with Chester to the southeast and nearby stations at Queensferry, Shotton and Flint to the north- west.

1.3.5 The location of the Scheme within the wider region is shown in Figure 1.1. Further details of the Scheme are provided in Chapters 2 and 3 of this ES.

Figure 1-1 Location Plan



1.4 Context and Scheme History

1.4.1 The Welsh Government is responsible, as the highway authority, for all Motorway and Trunk Road networks in Wales. The A55, A550 and A494 corridor forms a primary East-West link between Queensferry / Ellesmere Port / north-west of England and the rest of North Wales.

1.4.2 The River Dee Bridge is in need of replacement. In recent years, there is evidence that the concrete deck of the bridge is deteriorating, and this may have been occurring over years. The deterioration has continued despite routine maintenance and repairs by North and Mid Wales Trunk Road Agent (NMWTRA). Enhanced monitoring and interventions are necessary to maintain the operational condition of the carriageway. Currently there is a prohibition restricting the movement of abnormal loads over the structure. Major maintenance and/or refurbishment has become essential. Closure of the bridge would result in serious disruption including long distance diversions and disruption to the local road network and nearby communities over a lengthy period of time so needs to be avoided at all costs.

1.4.3 Replacement of the existing A494 River Dee Bridge as a major asset renewal forms the basis of the Scheme. It is not practical to close the A494 to replace the existing bridge and so all the options under consideration include the provision of a new structure close to the south-eastern side of the existing bridge, to accommodate all traffic in both directions to enable the replacement of the existing bridge. The completed project would subsequently provide a single replacement bridge with two lanes of traffic in each direction and a total distance of 1.25km improved carriageway either side of the bridge.

1.4.4 The replacement bridge will have a similar form as the existing structure with two river piers and be located approximately 6.65 metres south-east of the existing structure. New sections of carriageway would need construction to connect the new bridge to the existing A494 road corridor. It is anticipated that the new bridge and connections could be open to all traffic by the end of 2029 subject to the consenting process, procurement of a contractor and construction programme.

1.5 Scheme Objectives

Transport Planning Objectives (TPOs)

1.5.1 The following Transport Planning Objectives (TPOs) were aligned with Welsh Government and formalised as part of Stages 0/1 and 2 of the WelTAG process, to provide clear aims for the project. Stakeholders participated in the setting of these TPOs which are set out in their final form as part of the WelTAG Stage 2 report.

1.5.2 The Scheme's SMART objectives have been reviewed and updated to reflect the latest policy ambitions and priorities and are to:

i) Maintain connectivity of the A494 strategic corridor by addressing the life expired River Dee Bridge.

ii) Maximise opportunities for modal shift through better provision for alternative modes.

iii) Minimise scheme whole-life carbon emissions through applying carbon reduction measures to design, construction, and operation.

iv) Maintain and enhance the local environment by securing long term net benefit for biodiversity.

v) Improve resilience on the A494 corridor by minimising the impacts of incidents and accidents and enhancing safety for road users and maintenance personnel.

vi) Maintain connectivity along the A494 strategic corridor during construction to minimise impacts on residents, businesses, strategic and local traffic.

Environmental Objectives

1.5.3 A set of draft Environmental Objectives (EOs) have been developed by the project team to align with Welsh Government planning and environmental policies and to improve and enhance the environmental performance of the best performing scheme option (Option E). The nine EO's are set out below:

i) Protect and safeguard the designated site of the River Dee by avoiding or minimising adverse environmental impacts.

ii) Enhance ecosystem resilience and secure long-term benefits for biodiversity.

iii) Minimise environmental risks such as air and noise pollution and those posed by flood risk and coastal change.

iv) Improve connectivity to adjacent ecosystems and deliver positive enhancement measures.

v) Protect and enhance the biodiversity and value of the soft estate and its resilience for future change.

vi) Secure long-term mitigation and enhancement measures that are effective and resilient to climate change.

vii) Deliver a network of green infrastructure and open green spaces and soft estate.

viii) Minimise the use of carbon and reduce greenhouse gas emissions arising from construction and operational phases of the bridge replacement scheme.

ix) Ensure short-and long-term environmental mitigation and management measures are in place through the construction and operational stages of the scheme.

1.6 Statutory Framework and Purpose of the Environmental Statement

Purpose of EIA

1.6.1 EIA is a means of identifying and collating information to inform an assessment of the likely significant environmental effects of a project. The findings of the EIA process are reported in an ES to ensure that, when deciding whether to grant consent for a project, the decision-maker has access to information regarding the likely significant effects on the environment. This allows the consideration of effects in the decision-making process. The requirement to prepare an ES is set out in law.

The EIA Directive

1.6.2 The EIA legislative framework in Wales relating to highways originates from European Council Directive 85/337/EEC as amended by EC Directive 97/11/EC and the Public Participation Directive 2003/35/EC.

1.6.3 The 2011 European Directive 2011/92/EU, and the most recent 2014 Directive (as amended) 2014/52/EU[4] are known collectively as the EIA Directive. The Directive requires EIA to be completed in support of an application for development consent for certain types of schemes.

1.6.4 The Directive 2014/52/EU requires Member States to transpose its requirements into national law.

The EIA Regulations

1.6.5 For highways schemes promoted under the Highways Act 1980 (as amended), the requirements of the EIA Directive are currently transposed by The Highways (Assessment of Environmental Effects) Regulations 1999 and The Highways (Environmental Impact Assessment) Regulations 2007 and more recently by the Environmental Impact Assessment (Miscellaneous Amendments Relating to Harbours, Highways and Transport) Regulations 2017. The latter came into effect on the 5th of December 2017. These Regulations are collectively referred to hereafter as the EIA Regulations.

1.6.6 A marine license is required from Natural Resources Wales (NRW) in respect of elements of the works under the provisions of the Marine and Coastal Access Act 2009. There are separate requirements in respect of EIA in the grant of such licenses set out in the Marine Works (Environmental Impact Assessment) Regulations 2007 (as amended).

[4] Directive 2011/92/EU on the assessment of the effects of certain public and private projects on the environment. Available at: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A32014L0052 (Accessed May 2019).

1.6.7 This ES has been prepared in accordance with the requirements of the Highways Act 1980. It is intended that this ES provides sufficient information to allow consideration of the marine licence application by the NRW Marine Licensing Team.

1.7 Requirement for EIA

1.7.1 Guidance in relation to the procedure for determining whether an EIA is required for highways schemes is set out in the DMRB LA 102 Screening projects for Environmental Impact Assessment. This requires that a 'determination' process be followed for certain highways schemes. More details on this process are reported in ES Chapter 4.

1.7.2 The proposed A494 River Dee Bridge Replacement has been determined as requiring an EIA. The means of making this determination is set out in an Annex II and Annex III of the EIA Regulations. In Annex II of the EIA Regulations, the Scheme is shown to be a 'relevant project', and passes size and sensitive area criteria, '*a project for constructing or improving a highway where the area of the completed works together with any area occupied during the period of construction or improvement by requisite apparatus, equipment, machinery, materials, plant, spoil heaps or other such facilities exceeds 1 hectare or where any such area is situated in whole or in part in a sensitive area*'.

1.7.3 Annex III requires the characteristics of the Scheme, the location of the Scheme in relation to sensitive areas, and the characteristics of any potential impacts to be considered. The Scheme is located across the River Dee, which is a Special Area of Conservation (SAC) and a Site of Special Scientific Interest (SSSI). There is potential for the construction and operation of the Scheme to have effects on these special characteristics of the site. Therefore it has been determined that an EIA is required.

1.8 Scope and Content of the Environmental Statement

1.8.1 Although there is no statutory provision as to the form of an ES, Section 105A of the Highways Act 1980, as amended, requires that the ES must contain the information referred to in Schedule 4 of the EIA Regulations (as amended) 2017. Information to be included in environmental statements is summarised below:

1 a description of the proposed project including in particular

a) A description of the location of the project

b) a description of the physical characteristics of all the works, including, where relevant, requisite demolition works, and the land use requirements during the construction and operational phases:

c) a description of the main characteristics of the operational phase of the project

d) an estimate, by type and quantity, of expected residues and emissions resulting from the operation of the proposed project

2. A description of the reasonable alternatives studied by the applicant and an indication of the main reason for selecting the chosen option, including a comparison of the environmental effects.

3. A description of the relevant aspects of the current state of the environment (baseline scenario) and an outline of the likely evolution of the environment without implementation of the proposed works as far as natural changes from the baseline scenario can be assessed with reasonable effort on the basis of the availability of environmental information and scientific knowledge.

4. A description of the factors specified in rule 7A(2) likely to be significantly affected by the project: population, human health, biodiversity (for example fauna and flora), land (for example land take), soil (for example organic matter, erosion, compaction, sealing), water (for example hydromorphological changes, quantity and quality), air, climate (for example greenhouse gas emissions, impacts relevant to adaptation), material assets, cultural heritage, including architectural and archaeological aspects, and landscape.

5. A description of the likely significant effects of the project on the environment resulting from, amongst other things—

a) the construction and existence of the project, including, where relevant, demolition works;

b) (b) the use of natural resources, in particular land, soil, water and biodiversity, considering as far as possible the sustainable availability of these resources;

c) the emission of pollutants, noise, vibration, light, heat and radiation, the creation of nuisances, and the disposal and recovery of waste;

d) the risks to human health, cultural heritage or the environment (for example due to accidents or disasters);

e) the cumulation of effects with other existing or approved projects, taking into account any existing environmental problems relating to areas of particular environmental importance likely to be affected or the use of natural resources;

f) the impact of the project on climate (for example the nature and magnitude of greenhouse gas emissions) and the vulnerability of the project to climate change;

g) the technologies and the substances used

6. A description of the forecasting methods or evidence used to identify and assess the significant effects on the environment, including details of difficulties (for example technical deficiencies or lack of knowledge) encountered compiling the required information and the main uncertainties involved.

7. A description of the measures envisaged to avoid, prevent, reduce or, if possible, offset any identified significant adverse effects on the environment and, where appropriate, of any proposed monitoring arrangements

8. A description of the expected significant adverse effects of the project on the environment deriving from the vulnerability of the project to risks of major accidents or disasters which are relevant to the project concerned.

9. A non-technical summary of the information provided under paragraphs 1 to 8.

10. A reference list detailing the sources used for the descriptions and assessments included in the environmental statement.

1.8.2 The information supplied within this ES is considered to provide a clear understanding of the likely significant effects of the Scheme on the environment. Further detail regarding the scope of the ES in relation to legislative requirements is provided in Chapter 5 of this ES.

1.8.3 Traffic forecasting in this ES was based on a First Forecast Year of 2027 to represent the two years of construction (2027-2028) and also the opening year (for the transport economic appraisal) of 2029, so Welsh Government have taken this date as the basis of 'Opening Year' assessment. A second Forecast Year of 2044 has also been used to represent traffic figures 15 years after the scheme opening.

1.9 Structure of the Environmental Statement

1.9.1 The ES is structured to allow relevant environmental information to be easily accessible. This volume of the ES (Volume 1) includes the main text of the ES. Chapter 2 provides a description of the Scheme and information relating to its construction. Chapter 3 provides information relating to the main alternatives considered during the evolution of the Scheme and the reasons for the choices made and Chapter 4 outlines the approach and methodology adopted during the EIA process. The legislative and policy context is set out in Chapter 5. Chapters 6 to 16 contain topic by topic environmental information, with Cumulative Effects in Chapter 17, Environmental Management in Chapter 18 and the ES overall summary and conclusions within Chapter 19.

1.9.2 Figures and appendices which accompany the text of the ES are included separately in Volume 2 and 3, respectively. Volume 3 includes specialist reports providing relevant background and technical information.

1.9.3 A Non-Technical Summary (NTS) of the ES, using non-technical terminology, is available in Welsh and English.

1.9.4 The overall structure of the ES is shown in Table 1.1 and abbreviations and acronyms in Table 1.2

Table 1.1: Structure of ES

Document or chapter	Subject/purpose
Non-technical summary	Summary of the ES using non-technical terminology
Volume 1	**Technical Assessment Report**
Chapter 1	Introduction
Chapter 2	The Project
Chapter 3	Alternatives considered
Chapter 4	Approach to Environmental Assessment
Chapter 5	Legislative and Policy Context
Chapter 6	Geology and soils
Chapter 7	Road drainage and water environment
Chapter 8	Biodiversity
Chapter 9	Landscape and visual effects
Chapter 10	Cultural heritage
Chapter 11	Air Quality
Chapter 12	Noise and vibration
Chapter 13	Material assets and waste
Chapter 14	Population and human health
Chapter 15	Climate
Chapter 16	Marine Environment
Chapter 17	Cumulative Effects
Chapter 18	Environmental Management
Chapter 19	Summary and Conclusions
Volume 2	**Figures**
Volume 3	**Appendices**

1.10 Abbreviations and Acronyms

Table 1.2: Abbreviations and acronyms used within the ES.

Acronym	Definition
AIES	Assessment of Implications for European Sites
BCT	Bat Conservation Trust
BNL	Basic Noise Levels
BPM	Best Practicable Means
BRP	Bat Roost Potential
BSI	British Standards Institution
CEMP	Construction Environmental Management Plan
CIEEM	Chartered Institute of Ecology & Environmental Management
CNMP	Construction Noise Management Plan
CROW	Countryside Right of Way Act
CRTN	Calculation of Road Traffic Noise
CWAC	Cheshire West and Chester Council
DMRB	Design Manual for Roads and Bridges
EB	Eastbound
ECO	Environment Co-ordinator
ECOW	Environmental Clerk of Works
EIA	Environmental Impact Assessment
ELG	Environmental Liaison Group
FCC	Flintshire County Council
FLDP	Flintshire Local Development Plan 2015-2030
FUDP	Flintshire Unitary Development Plan
GLVIA3	Guidelines for Landscape and Visual Impact Assessment - Third Edition
HRA	Habitat Regulations Assessment
HSI	Habitat Suitability Index
IAN	Interim Advice Note
IAN 135/10 (W)	Interim Advice Note 135/10 (W) Landscape and Visual Effects Wales Only
IAQM	Institute of Air Quality Management
IEMA	The Institute of Environmental Management and Assessment
INNS	Invasive Non-native Species
JNCC	Joint Nature Conservation Committee
LCA	Landscape Character Area
LDP	Local Development Plan

Acronym	Definition
LOAEL	Lowest Observed Adverse Effect Level
LSE	Likely Significant Effect
LVIA	Landscape and Visual Impact Assessment
MCA	Marine Character Area
MCC	Maintenance Control Centre
NCA	National Character Area (England)
NERC	Natural Environment and Rural Communities
NLCA	National Landscape Character Area (Wales)
NMU	Non-motorised User
NMWTRA	North and Mid Wales Trunk Road Agent
NPSE	Noise Policy Statement for England
NRW	Natural Resources Wales
OS / OSGB	Ordnance Survey/ Ordnance Survey Great Britain
PPV	Peak Particle Velocity
PPW	Planning Policy Wales
TAN	Technical Advice Note
TPO	Tree Preservation Order
TPOs	Transport Planning Objectives
TRL	Transport Research Laboratory
SOAEL	Significant Observed Adverse Effect Level
SuDS	Sustainable Urban Drainage Systems
RML	Richards, Moorehead & Laing Ltd
SAC	Special Area of Conservation
SIAA	Statement to Inform an Appropriate Assessment
SPA	Special Protection Area
SPG	Supplementary Planning Guidance
SSSI	Site of Special Scientific Interest
TRL	Transport Research Laboratory
TWG	Technical Working Group
VERs	Valued Ecological Receptors
WB	Westbound
WBFG	Well Being of Future Generations Act
WCA	Wildlife & Countryside Act
WCE	West Coast Energy
WDP	Wales Biodiversity Partnership
WelTAG	Welsh Transport Appraisal Guidance (2024)
ZTV	Zone of Theoretical Visibility

1.11 The Assessment Team

1.11.1 The Welsh Government (as the Overseeing Organisation) awarded a Professional Services Contract for the Scheme development and environmental surveys, including publication of the ES and up to any Public Local Inquiry. Welsh Government awarded the contract to Mott MacDonald (MM) supported by Richards, Moorehead & Laing Ltd (RML).

1.11.2 The EIA process is managed by a team from RML, considering information and assessments provided by the Welsh Government and the design team. Individual chapters have been prepared by authors from MM and RML.

1.12 Publication of the Environmental Statement

1.12.1 This ES is submitted alongside the draft Orders for the Scheme. Statutory Orders are prepared by Welsh Ministers and published in draft. The draft Line Order now published would provide for the new sections of trunk road and a replacement bridge over the River Dee. The draft Side Roads Order now published would deal with local highway matters (including roads, footpaths, and cycleways), and private means of access. A draft Compulsory Purchase Order provides for the acquisition of the land and rights required.

1.12.2 The documents and information are available to view on the Welsh Government website: https://www.gov.wales/a494-river-dee-bridge. The statutory public notices for the draft Orders and the ES set out the publication periods and arrangements in place to enable persons to inspect the documents placed on deposit.

1.12.3 Details of the EIA assessment team are provided in Table 1.3.

Table 1.3: Assessment team

Name	Position & Organisation	EIA Role and Responsibilities	Professional qualifications
Jonathan Stoddard	Principal Landscape Architect, RML	Environmental Co-Ordinator	BA (Hons) Grad Dip CMLI
Clive Williams	Senior Associate Contaminated Land MM	Geology and Soils	BSc MSc CGeol
Clare Postlethwaite	Senior Associate – Environment and Sustainability - MM	Road drainage and water environment	BSc (Hons) MSc MCIWEM CEnv CSci
Donna Hall and Adam Lynch	Principal Ecologist, & Ecologist - RML	Terrestrial Biodiversity	MSc MCIEEM
Rhodri Edwards	Senior Landscape Architect - RML	Landscape and visual chapter lead	BA Hons, Dip LA Hons
David Maynard	Archaeologist - RML	Cultural heritage	BSc (Hons) MIFA
Hannah Walley	Air Quality Consultant - MM	Air Quality	MSc BSc (Hons)
Adrian Morgan	Principal Acoustic Engineer	Noise and vibration	MSc, IOA Diploma in Acoustics and Noise Control, MIOA
Anita Manns	Senior Associate Waste and Resource Management - MM	Material Assets and Waste	BA (Hons) SWRAC Assessor
James Beard	Technical Director and Global Practice Leader for Social Outcomes	Population and Human Health	BSc BA (Hons) CIWEEM
Ben Skinner	Principal Carbon Management Consultant - MM	Climate	MESci MIEMA CEnv
Aneira Jones	Marine Environmental Scientist	Marine Environment	MSc GradCIWEM
Andrew Sumner	Principal Landscape Architect and Environmental Coordinator RML	Cumulative effects & Environmental Management	BA (Hons) Grad Dip CMLI

1.13 Next Steps

1.13.1 Should you wish to support or object to the draft Statutory Orders, put forward an alternative proposal, or comment on the Environmental Statement, you should write to the Welsh Government at the address below or visit the website.

Orders Branch, Transport
Welsh Government,
Cathays Park,
Cardiff, CF10 3NQ.

A494 River Dee bridge | GOV.WALES:

1.13.2 All such correspondence will be addressed in accordance with the guidance on data protection and should be sent to arrive at the above address no later than the end of the objection and comment periods, as advised in the statutory public notices.

1.13.3 The Welsh Government will consider all the responses to the draft Orders and then decide whether to hold a Public Local Inquiry. Such Inquiries are held before an independent Inspector who would hear and consider the evidence both for and against the published Scheme and subsequently report the findings and recommendations to the responsible Welsh Ministers. The Welsh Ministers would consider all issues before deciding whether to proceed with the Scheme and, if so, to make the Orders with or without modification.

1.13.4 Subject to the above process, the key anticipated dates for progressing the Scheme are set out below:

a)	Public Local Inquiry (if required):	Spring/Summer 2026
b)	Ministers' decision to proceed:	Summer 2026
c)	Site enabling works:	Autumn 2026 (earliest possible date)
d)	Start of construction*:	Winter/Spring 2027
e)	Completion Construction Works:	Summer/Autumn 2029

* *Construction programme is subject to utility diversion timescales*

Llywodraeth Cymru / Welsh Government

A494 RIVER DEE BRIDGE REPLACEMENT SCHEME

Environmental Statement

Volume 1: Technical Assessment Report

Chapter 2: The Project

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2. The Project

2.1 Introduction

2.1.1 This chapter provides a description of the Scheme together with the process of construction, which forms the basis for the environmental assessment described in this Environmental Statement (ES).

2.1.2 The preferred option (best performing option E) has been selected from a shortlist of four options that have been taken through the WelTAG (Stages 0,1, 2 and 3) appraisal process. This option scored well in the WelTAG appraisal due to the following key aspects:

a) Strong alignment with the priorities and requirements of the Wales Transport Strategy.

b) Minimised construction impact with the bulk of the construction undertaken without disrupting current traffic using the A494.

c) Better opportunities to minimise the level of carbon during construction and reuse existing land for biodiversity improvement.

d) Reduced impact on third party assets such as the North Wales Coast Railway and public utility supplies such as electricity, water/sewage and gas supply cables and pipes.

e) Improved active travel facilities with new links and connections.

f) Lower construction carbon and capital cost.

2.1.3 The preferred option consists of constructing a new replacement bridge of a similar length to that of the existing bridge to carry two lanes of eastbound and westbound traffic and a shared use path for cyclists and pedestrians. The replacement bridge would be located approximately 12 metres to the southeast of the existing A494 River Dee Bridge, construction works are proposed to take place ‘offline’ of the existing highway and allow the A494 to remain open during the majority of construction period.

Key features of the preferred option

2.1.4 The key features of the preferred option are:

i) A new bridge to replace the existing bridge that is in a poor and deteriorating condition.

ii) A new shared use path for pedestrians and cyclists running along the southeast side of the westbound carriageway. This would connect to the Wales Coast Path and other active travel routes in the area.

iii) Improvements to the existing A494 to the east of where the road passes under the North Wales Coast Railway Line. This would include introducing a new hard shoulder in each direction connecting to the existing hard shoulders to the east of the River Dee, alignment improvements and sustainable drainage systems.

iv) A new and improved left in / left-out priority junction from the westbound carriageway of the A494 connecting to the Riverside Gypsy Travellers site, commercial properties and the river pumping station located on the southwest bank of the River Dee. Diversion of the Queensferry Drain (a Natural Resources Wales main river), which is situated on the southeast side of the A494 and currently flows in a culvert beneath it, west of the North Wales Coast Railway Line and in open channel east of the railway line. New sections of open channel would be provided either side of the railway with a section of existing culvert beneath the railway line being retained.

v) A new river pumping station and drainage outfall to the River Dee.

vi) Environmental mitigation and biodiversity enhancement works with earthworks and areas of soft estate including wildflower verges, swales, native woodland plantations and amenity grassland.

vii) Removal of the existing A494 River Dee Bridge deck, cross heads and abutments and retention of the two existing river piers in-situ.

2.1.5 A more detailed description of the Scheme proposals is set out below along with environmental mitigation measures and a description of the construction techniques that are considered likely to be needed to construct the scheme safely. A more detailed description of the options and alternatives to the preferred Scheme selected are set out in Chapter 3 of this ES and also in the WelTAG reports for stages 0,1, 2 and 3.

2.2 Context

2.2.1 The River Dee is a major river that originates in the hills of Snowdonia National Park and flows through the Vale of Llangollen and the city of Chester, before continuing downstream through the Dee Estuary to the Irish Sea. At the point where the A494 bridge crosses, the river is tidal and has been canalised upstream for the most part from Connah's Quay to Chester and Chester Weir. The river is designated as both a Site of Special Scientific Interest (SSSI) and Special Area of Conservation (SAC), primarily for its range of habitats and migratory fish.

2.2.2 Historically, the river served as a vital trade route to Chester. However, navigation was often hindered by build-up of sediment on the river bed. To address this, the river was canalised in the early 1700s to ensure the river was navigable for ships to reach Chester. The canalisation works were designed and carried out by Dutch engineers, funded by local merchants and Chester Corporation. Their goal was to ensure larger vessels to reach Chester more reliably. The new canal portion opened for river traffic in 1737. This engineering effort also enabled the reclamation of former marshland in the Shotton and Queensferry areas with the excavated material used to create embankments on both sides of the river.

2.2.3 The River Dee Bridge is a strategic component of the A494 road corridor where it crosses the river. The bridge was originally constructed in 1960 and this section of the A494 opened to traffic in 1962. Since then, the nearby settlements of Queensferry and Garden City have expanded significantly along with other forms of urban and industrial development. As a result, the A494 road corridor has become increasingly constrained by development on both sides of the river with the exception of land to the south-east which remains as agricultural land. These constraints have had a major influence on the design of the new Scheme. Due to the limited space available elsewhere, the only viable option was to consider a replacement bridge to the south-east—an area with fewer constraints and where connections to the existing A494 could be made on both sides of the river.

2.2.4 South of the A494 road corridor and Dee Bridge, the southern bank of the River Dee is almost entirely in urban use and comprising of industrial sites, utilities, commercial properties and residential areas.

2.2.5 Adjacent to the existing A494 road corridor are terraced residential properties forming the edge of Queensferry. The backs of the closest houses look out across the A494 with their gardens and garages backing onto an alleyway and brick wall immediately adjacent to the A494 carriageway and footway. Further north-eastwards along the A494 lies the Expressway Business Park, reached via the B5441.

2.2.6 To the north of the existing Dee Bridge are residential streets, including Claremont Avenue and Riverside Park, both part of Garden City, running parallel with the A494. These are separated from the A494 by a highway noise barrier, strip of vegetation and existing trees on the embankment supporting the existing A494 above the level of these streets. The residential properties of Claremont Avenue were built following the completion of the A494 on land formerly occupied by Sealand Nurseries.

2.2.7 The North Wales Coast Railway Line runs parallel with the River Dee, approximately 250m to the south-west. Its embankment forms a visual barrier and divide between the commercial – industrial riverside land and the residential – retail centre of Queensferry, beyond which is the rising land to the south.

2.2.8 Beyond Queensferry, and to the west of the Dee Bridge, is an extensive residential area around the urban centres of Shotton and Aston. These areas contain a wide range of community facilities, including primary and secondary schools, play areas, community centres, Deeside Community Hospital, banks, post offices, public houses, places of worship and Shotton Railway Station. The 2021 census indicates that the settlement population of Flintshire was 155,812.

2.2.9 To the south of the existing bridge and south-west side of the river lies a permanent gypsy traveller site and a transport yard. Further west towards Queensferry lie Dŵr Cymru Welsh Water's treatment works and several industrial sites at the western end of Sandycroft Industrial Estate.

2.2.10 Ferrybank Farm and the community of Sealand are located to the north and east of the existing bridge and River Dee. This area is largely agricultural with large fields set to arable land and with extensive areas designated as green wedge in the Flintshire LDP.

2.3 Description of the Scheme

Replacement Bridge

2.3.1 The Scheme is for the replacement of the existing bridge with a similar structure and span of approximately 140 metres and an increased width of 36.5 m. The bridge would be at a similar height above the River Dee with the surface of the deck circa 7.3 m above the river level (Mean High-Water Spring - MHWS) due to the need for reconnecting to the existing A494 road corridor on both sides of the river.

2.3.2 There would be two lanes of traffic in each direction and a hard shoulder on both the east and westbound carriageway. A shared use path for active travel provision would run along the southern side of the bridge.

2.3.3 The bridge would be supported by two sets of river piers. Each river pier would be constructed using 12 no. piles approximately 1.5 m in diameter. The river piers would be in a similar orientation as the existing and distance from the top of each riverbank but approximately 6 metres further upstream to the south-east.

A494 Road Corridor

2.3.4 There would be improvements to the existing A494 road corridor either side of the replacement bridge to connect to the existing east and westbound carriageways. The existing highway network would be modified at the tie-ins where the proposed re-aligned carriageway would re-join the existing carriageway.

2.3.5 A new left in/left out access from the westbound carriageway of the A494 to the Riverside Gypsy Travellers site, commercial properties and to a new river pumping station.

Active Travel and shared use routes

2.3.6 Up to 3km of new and improved walking and cycling routes are proposed as part of the Scheme. The improvements include a new full traffic free route for cyclists and pedestrians over the River Dee connecting the Wales Coast Path east of the River

to Queensferry Interchange and the centre of Queensferry in the west. New and improved links are also proposed to Station Road and Factory Road.

2.3.7 The new routes will provide safer new connections between communities and places of interest and works, facilitating alternative journey options to using cars for local journeys and for longer distance journeys with connections to the Wales Coast Path and National Cycle Route 568.

2.3.8 The active travel proposals will open up greater opportunities for Flintshire Council to deliver more active travel routes in future years and speed up delivery of active travel facilities in the surrounding areas. A traffic free route over the River Dee will allow people and businesses on both sides of the river to connect to one another more sustainably.

Public Rights of Way

2.3.9 Existing footpaths, bridleways and private means of access that would be affected by the Scheme would be suitably diverted. The following public rights of way would require modification: -

a) Footpath between B5441 Station Road and River Dee alongside the A494 eastbound carriageway, passing between Territorial and Army Volunteer Reserve(TAVR) Centre and Lindop Toyota, would be improved to cater for all users.

b) Footpath on western bank of River Dee beneath existing bridge would be connected to the new path across the River Dee.

c) Footpath – cycleway alongside the westbound carriageway, north-east of the River Dee, would be modified to connect to the new shared use route across the river on the new bridge.

d) Public right of way between Chemistry Lane / Factory Road junction and the River Dee would be maintained as part of the proposed new access road.

Demolition of property and existing bridge

Demolition of properties

2.3.10 The following properties would be demolished as a result of the Scheme:

- Haulage business workshop, building and yard situated immediately southeast of the existing A494 and on the west bank of the River Dee.
- NRW river pumping station and Scottish Power sub-station (within the same building) situated to the northeast of the existing Riverside Way junction.
- Old Flintshire Depot and storage yard on Chester Road East, adjacent to the railway line.
- Four former residential properties, known as 1 – 4 Bridge Houses, located on Chester Road East, approximately 200m east of Queensferry Interchange. These properties have been vacant since approximately 2006-2008, and are substantially vandalised despite being boarded up.

Demolition and removal of existing bridge

2.3.11 Following completion of the replacement bridge and opening to traffic, the existing bridge deck would be removed but the existing river piers would remain in-situ. A temporary 'crash deck' platform would be installed under the existing bridge (mounted on existing abutments and piers and steel beams) to capture any loose materials during removal of the deck. This would involve breaking out the concrete from the centre of the span towards the abutments, with materials removed for recycling. The crash deck located beneath the beams would then be dismantled, although sections around the piers and abutments would be retained.

2.3.12 Working from a jack-up barge the existing pier concrete crossheads would be demolished and removed. The existing river piers would remain in-situ and may be modified in the future to improve their aesthetic appearance.

2.3.13 The existing gantry that spans the A494 road corridor on the east side of the bridge would also be removed as along with the existing carriageway. The bridge abutments would also be demolished, and the adjacent embankments regraded to tie in with the surrounding landscape.

Site Compounds

2.3.14 The extent of the Scheme includes two areas that will be needed for the construction phase of the project. These include a derelict area of land for the main site compound south-west of the River Dee and gypsy and traveller site at

Riverside, and another area that is currently agricultural land on the eastern bank of the river and south of the existing bridge along with access off the existing A494 westbound carriageway.

2.3.15 These areas would be acquired temporarily for the construction period and returned to their previous land use following completion subject to agreement with the landowner.

Highway Drainage

2.3.16 The Queensferry Drain (NRW “Main River”) currently flows in a culvert below the existing A494 (west of the railway line) and in open channel (east of the railway line) immediately to the southeast of the A494. Surface water runoff from both the proposed new carriageway and existing re-profiled carriageway will be collected and disposed of using a combination of underground piped drainage systems and open ditches.

2.3.17 To the west of the North Wales Coastline railway, existing gullies/outfalls along with run-off from the new active travel route will discharge into a newly created open channel (ditch) that replaces a length of the existing Queensferry drain between Chester Road East and the railway bridge. At the northern end of the open channel, a new pipe will then connect to the existing culvert that sits within the southern verge of the A494 and passes below the railway bridge. The existing culvert will be extended, and its outfall relocated on the north side of the railway to outfall to a further length of open channel that will replace the existing Queensferry ditch alignment running northwards towards Riverside Way. The ditch will be designed to accommodate the existing and proposed highway drainage, and the existing watercourse flows.

2.3.18 The ditch will outfall to a new culvert which would then pass through a new pumping station and outfall at the River Dee. The discharge rate from the pumping station would be agreed with National Resources Wales (NRW) as this will replace their existing pumping station. Due to the scale of the changes in the alignment of the carriageway, the existing drainage network along the A494 between the North Wales Coastline railway and the River Dee will be replaced. New surface water

carrier drains will be installed east of the railway up to the replacement bridge within the north and south verge of the new carriageway. A new drainage swale is proposed to the north of the new road for attenuation and treatment of surface water drainage.

2.3.19 Surface water collection on the river bridge would be in the form of a bridge deck drainage system which will discharge to the highway drainage system. The surface water collection on the carriageway will be in the form of traditional kerbs and gullies. An existing swale located to the south of the A494 (north of the River Dee) is to be reprofiled as part of the scheme proposals. Where no carriageway modifications will be undertaken, the existing drainage will be retained and any existing outfalls will be incorporated into the new network.

Basic Spillage Control and Water Treatment

2.3.20 To protect the Queensferry Drain, River Dee and Manor Drain in the event of an accident or spillage on the carriageway, penstocks would be fitted to the swales at the point of discharge to the surface watercourses. Spillages and/or contaminated water could then be isolated for controlled removal or treatment. The swales would also provide some attenuation and biological treatment of contaminants, as well as settlement / filtration of particulate matter, from the highway before the run-off reaches the watercourses.

Fencing

2.3.21 Fencing would be provided where there is a requirement to discourage pedestrian access and to delineate the Welsh Government land ownership. Further fences would be required to discourage access to hazardous locations such as culverts, the tops of retaining walls and steep slopes. Indicative alignments of proposed fences are shown in the General Arrangement Drawing at Figure 2-1 and the Environmental Masterplans included in Figures 2-2A, 2-2B, 2-2C and 2-2D.

Lighting

2.3.22 The existing bridge lies within the built-up area of Queensferry that is generally well lit with the lighting environment classified as E3 suburban and with a medium district

brightness. The existing A494 road corridor is also lit either side of the existing bridge. The Scheme would be lit throughout its length in accordance with current highway lighting standards and to make connections with the existing road corridor and footpath network.

Signs and Communications

2.3.23 The proposed section of road would incorporate signs in relation to junctions and destinations. Subject to further design, provision would be made for the installation of Intelligent Transport Systems (ITS) on the Scheme.

Utilities

2.3.24 The main utility companies with assets in the area are Dŵr Cymru Welsh Water, Wales and West Utilities, Scottish Power Energy Networks and BT Openreach. Key utility diversions within this scheme include:

a) Diversion of existing rising mains currently on the Dee Bridge (to be demolished) and along the A494. These mains would be diverted under the River Dee, to the south-east of the bridge. (Dŵr Cymru Welsh Water)

b) Diversion of 33kV cables to the north of Dee bridge, across the A494. (Scottish Power Energy Networks)

c) Diversion of a medium pressure gas main to the south of the Dee bridge, across the A494. (Wales and West Utilities)

d) Diversion of 11kV and low voltage cables across the scheme. (Scottish Power Energy Networks)

e) General BT diversions across the scheme. (BT Openreach)

2.3.25 The diversion works are anticipated to be undertaken directly by the utility companies and include gas mains, water and sewer mains, electricity cables and communications cables. The Welsh Government and the appointed contractor may carry out additional protection works and other civil engineering works to assist the utility companies.

Works to Watercourses

2.3.26 A new drainage outfall to the River Dee will be created to replace the existing as this currently falls within the construction footprint of the Scheme. A new Queensferry Drain Pumping Station facility would be provided to the west of the River Dee at the end of Chester Road East in Riverside.

2.3.27 Queensferry Drain is classified as a main river and is situated on the southeast side of the A494(T) and flows in a culvert beneath the road and in open channel east of the North Wales Coast Railway Line.

2.3.28 This would be diverted to enable the construction of the replacement bridge and the A494 road corridor, new sections of open channel will be provided either side of the railway with a section of existing culvert beneath the railway line being retained.

Soft Estate

2.3.29 Existing areas of soft estate north of the existing A494 that have developed since the road was constructed in the 1960s and now contains well established trees and other vegetation, would be retained and protected.

2.3.30 New areas of soft estate would be integrated within the Scheme with earthworks and areas of soft estate including wildflower verges, swales, native woodland plantations and amenity grassland. These areas are limited to the south-eastern sides of the Scheme where new embankments are needed to support the new sections of the A494 as they rise on the approaches to the bridge.

2.3.31 An area of intertidal habitat classified as salt marsh on the eastern bank of the River Dee would be affected by the construction of the replacement bridge. This would likely to be impacted by the over shadowing effect caused by the new bridge. The north-eastern bank of the river beneath the existing bridge is a concrete revetment devoid of any vegetation. This would be either removed or adapted to encourage a growing medium to form and encourage natural recolonisation of plants from the adjacent riverbanks.

Mitigation Measures

2.3.32 It is a requirement of DMRB LA104[1] that the environmental assessment should report on the following categories of mitigation:

i) embedded mitigation: project design principles adopted to avoid or prevent adverse environmental effects; and

ii) essential mitigation: measures required to reduce and if possible offset likely significant adverse environmental effects, in support of the reported significance of effects in the environmental assessment.

2.3.33 Embedded and essential mitigation measures have been integrated into the Scheme proposals for the purpose of minimising likely adverse environmental effects. Embedded mitigation is described in the project description and not repeated in each environmental factor assessment. The following embedded mitigation measures are integrated into the Scheme proposals and described below. Some would be incorporated into the physical design elements and others would be a requirement of the appointed contractor and incorporated into the contractor's Scope as a mandatory requirement.

Saltmarsh Habitat

2.3.34 The potential loss of the vegetation classified as saltmarsh that would lie beneath the replacement bridge and within the River Dee National Sites Network (formerly SAC) is difficult to mitigate against. The intertidal habitat would become over-shadowed by the new bridge, and it is likely that for this reason, the habitat would gradually deteriorate and in the long term, fail to survive. Therefore, the provision for off-site mitigation is proposed at Greenfield Marsh, a site some fifteen kilometres downstream to the north-west on the southern side of the Dee Estuary.

2.3.35 The foreshore of Greenfield Marsh near Walwen contains areas of saltmarsh habitat of variable condition including patches of rubble left as vestiges from an old landfill on the foreshore. The proposal is to remove these patches of rubble to encourage the natural colonisation of the adjacent habitat. This is considered

[1] DMRB LA 104 Environmental assessment and monitoring

proportionate to that lost as a result of the Scheme. Welsh Government would collaborate with Flintshire County Council (FCC) and NRW to progress with these proposals should the Scheme be consented.

River Dee and timing of the 'in river' works

2.3.36 The most sensitive environmental asset potentially affected by the Scheme is the highly protected River Dee and the embedded mitigation measures required to protect the river are crucial to the Scheme being consented. During the preparation of the EIA, a particular concern raised by the statutory environmental body (NRW) is "*the potential for underwater noise and vibration to cause disturbance and potential disruption of fish features migration on the Dee*"[2].

2.3.37 The noise and vibration associated with piling to form the foundations for the replacement bridge could have a direct effect on salmon and lamprey if conducted during the migration season and at night-time. For this reason, it has been agreed with NRW that the piling works would be restricted to daylight hours only to minimise the risk of disturbance to migrating fish. To construct the proposed bridge a piling rig mounted on a temporary platform or on a 'jack-up' barge would be used to drive thin steel tubes into the riverbed. When the tubes reach the required depth, bored piles will be constructed by positioning an auger inside the steel tube. This way the disturbance of the silt and vibration at the riverbed will be kept to a minimum and restricted only to the steel tube-driving operations thus reducing the quantity of suspended particulates and noise within the watercourse which may indirectly affect fish. This construction method would be classified as an embedded mitigation measure and a mandatory assumption.

Essential Mitigation Measures

2.3.38 In the development of the Scheme proposals, it was identified that to secure biodiversity enhancements as required by the Section 6 Duty of the Environment (Wales) Act 2016, additional land would be needed to provide opportunities for increased areas of soft estate that in turn could deliver net biodiversity benefits.

[2] NRW response (21-02-2025) to request for Scoping Opinion

The areas of soft estate provide opportunities for habitat creation such as provision of native species hedgerows, tree and shrub planting, swales, open ditches and species rich grasslands. The additional lands identified would run parallel to, and south of the A494 and contiguous with the areas of soft estate of the immediate road corridor. These areas would be secured through the implementation of the Scheme and long-term management arrangements put in place to improve biodiversity.

2.3.39 Essential mitigation measures are outlined within the relevant chapters of this ES. These measures are also summarised in the Record of Environmental Actions and Commitments (REAC), which forms part of the Outline Construction Environmental Management Plan (CEMP) in Appendix 18A.

2.4 Long Term Management

2.4.1 On completion of the construction phase, there would be a five-year aftercare period to ensure the establishment of the landscape and ecological elements of the Scheme. The environmental requirements for this period would be implemented through a Construction Environmental Management Plan (2nd iteration of the Environmental Management Plan (EMP) as set out in Chapter 18 of this ES.

2.4.2 At completion of the five-year period, responsibility for management of the soft estate and environmental mitigation measures would pass to Welsh Government together with a 'Handover Environmental Management Plan' (third iteration of the EMP) guiding the long-term management.

2.4.3 On completion of construction, the main components of the Scheme such as the replacement bridge and A494 road corridor would be owned and maintained by the Welsh Government. However some elements such as local roads, active travel routes, the diverted Queensferry Drain, and the river pumping station would be maintained by other public bodies, namely FCC and NRW.

2.4.4 General inspections and maintenance of the trunk road, structures, highway drainage and landscape/soft estate areas would be undertaken on a regular basis in accordance with the Design Manual for Roads and Bridges (DMRB) and maintenance manuals. More detailed maintenance would be undertaken as and

when required. The inspections and maintenance on and adjacent to the trunk road may involve traffic management for access and to ensure the safety of the workforce.

2.5 Scheme Land Take

2.5.1 A number of existing properties and buildings would require demolition to accommodate the proposed Scheme. Further land would be required along the new section of road for works to rights of way and means of access.

2.5.2 For clarity in this Environmental Assessment, the land taken for the Scheme is that shown within the boundaries on the Environmental Master Plans Figures 2-2A to 2-4D in Volume 2. As the design is refined, the land required for permanent and temporary use will also be refined and shown on the Compulsory Purchase Order drawings published alongside this Environmental Statement.

2.6 Construction Programme

Overall programme

2.6.1 The construction programme is dependent on several key constraints such as the diversion of utilities and any seasonal limits for works in the River Dee that may be imposed by NRW. Advance works to establish construction compounds, access points and to divert utilities are likely to begin before the main works. The construction activities and programme would be subject to modification during both the detailed design and the construction phases.

2.6.2 The key dates for construction are currently as follows:-

i) Early Site Works – Autumn 2026
ii) Main Works – Spring 2027
iii) New Road Open to Traffic – Autumn 2029
iv) Existing Bridge Removed – Spring 2030

2.6.3 Maintenance and aftercare of the environmental aspects of the Scheme including management and establishment maintenance of the soft estate would remain the responsibility of the contractor for five years after the completion of construction.

2.7 Pre-Construction Activities

Archaeological Investigations

2.7.1 Advanced archaeological surveys and watching briefs in accordance with the agreed Written Scheme of Investigation (WSI) would be undertaken in the preliminary stages of the project. Refer to ES Chapter 10 Cultural Heritage.

Temporary Land Take, Site Compounds and Storage

2.7.2 To carry out the construction works, it is essential that land is acquired for the duration of the works for use as site compounds (including offices, stores, accommodation areas and car parking), construction working areas (including for temporary works and haul routes), topsoil and other construction storage areas.. Land for the temporary storage of unsuitable (including contaminated) material awaiting removal for recycling or disposal would also be required.

2.7.3 One or more batching plants for the preparation of concrete may be needed to minimise the road haulage of concrete and ensure that concrete is available at work locations precisely when required. This/these would be sited in the site compounds.

2.7.4 Two such areas have been identified and included in the draft Orders for the SchemeSite Compound Area 1 would accommodate the site offices and provide access to the assembly area for the replacement bridge components. The site is located off Chester Road East, close to the Riverside gypsy and traveller site.

a) Allows vehicle access to and from the A494 with minimal additional use of the local road network or from Chester Road East.

b) Connects directly to the bridge construction area in the former FCC depot and so avoids the need to use further public roads to distribute plant and materials.

c) Avoids taking ‘green field’ land or other public amenity space.

d) Would be available throughout the construction period as it is outside the permanent works boundary.

e) Would allow the cleared and restored site to be returned for new use at the end of the project.

2.7.5 Site Compound Area 2 would accommodate plant, materials and staff for the river bridge works and provide lay-down space as well as access to the works for large cranes and similar equipment. The site is located on the northern bank of the River Dee, on the eastern side of the existing A494 embankment. The land is currently in agricultural use for arable crops. The access would therefore be kept away from Ferrybank Farm. The cycle route along the base of the A494 embankment would be temporarily diverted to a new route between Fox's Drive and the River Dee path. Use of this site:

a) Allows vehicle access directly off the westbound A494 via a short length of temporary road.

b) Gives direct access needed for construction of the replacement bridge.

c) Is large enough for the assembly and placing of large bridge components.

d) Is not adjacent to residential or other public amenity space apart from the riverside path (which is unavoidable)

e) Would be available throughout the construction period, as it is outside the permanent works boundary.

f) Would allow the cleared site to be restored and returned to its current use at the end of the project subject to agreement with landowner.

Demolition

2.7.6 Demolition works would be undertaken by the contractor in accordance with method statements approved by the regulator and the local planning authority. Pre-demolition surveys would be undertaken as required. Demolition audits would be undertaken to identify any materials that could be recovered for re-use or recycling. Any structures that are known to support bat roosts would be demolished in accordance with a European Protected Species Licence issued by NRW.

2.8 Key Construction Activities

2.8.1 The key construction activities and sequencing of each would be identified by the appointed contractor. However, during the preparation of the EIA, several aspects of the construction methodology have been considered to inform the EIA process. This has focussed on the in river working due to the environmental sensitivities of the River Dee and marine biodiversity and may still subject to further dialogue and

discussions with NRW. It is currently anticipated that a jack up barge would be needed to install the piles and river piers and to remove the existing bridge deck and cross heads. The existing river piers would remain in-situ.

2.8.2 The construction activities are described in the following stages and have been developed as part of the anticipated construction methodology. These may change if the appointed contractor chooses an alternative approach, however, specialist contractors have been consulted in arriving at these stages and are therefore considered to be feasible and describe the most likely construction sequencing. The overall construction period is anticipated to take between 2-3 years with a target date of spring 2027 for the start of the main works.

Site Clearance

2.8.3 The initial activities following site establishment would be fencing site clearance, the installation of pre-earthworks drainage and topsoil strip under archaeological supervision where identified as required.

Mobilisation

2.8.4 Mobilisation would commence once the contractor has been appointed and the detailed design and necessary approvals are in place to undertake the works, including the approval of any statutory licenses, consents and permits. The extent of mobilisation works would be determined by the contractor; however, it is expected to include the following:

i) Possession of the land and demolition of the remaining structures to the south of the A494 between the railway bridge and Queensferry Interchange to provide a material storage area during the next stage

ii) Construction of the revised local highway arrangement to access the traveller site and main compound area, this would include all necessary utility diversions, drainage, kerbing and pavement.

iii) Construct the new pumping station and associated outfall for the Queensferry Drain, divert the river through the new infrastructure (this would be phased with the utility diversions)

iv) Implement temporary walking and cycling route diversions, it will be necessary to provide temporary routes whilst the permanent routes are implemented from the traveller site to the Queensferry Interchange.

v) Establish main office and stores compound within the existing hard standing area to the west of the travellers site

vi) Install a new temporary access from the A494 to the east of the river Dee to gain access to the satellite stores, office and welfare facility

vii) Commence works on the eastern crane platform and temporary jetty to facilitate mobilisation of the Jack-up barge and service the in-river operations

viii) Install a mooring facility and crane platform to the eastern bank. This will be used during high tides only to remove the need to dredge the intertidal bed. The barge will be loaded by crane at high tide and used to transport materials to the barge. Approximate use will typically be three times per week

ix) Mobilise the jack-up barge and transport this to site. The barge will be loaded with all equipment to undertake the piling operations including a service crane and piling rig. The jack-up barge would be quarantined at River Mersey Dry-Dock prior to being towed into position adjacent to the temporary jetty on a rising high tide.

x) Environmental mitigation works.

xi) Diversion of rising main sewers, either fully or temporarily at points of conflict with the proposed bridge abutments.

xii) Diversion of 33kV overhead electricity cables located to the east of the river.

xiii)

River Pier Works (RPW)

RPW Stage 1 – Mobilisation and Initial Setup

2.8.5 Mobilise ‘jack-up’ barge to the position of the new pier. Mobilise cranes and smaller plant. Install temporary anchor piles on riverbanks, riverbanks to form fixed points for tethering floating barge(s) if needed.

RPW Stage 2 – Installation of Steel Casing Tubes

2.8.6 Using tracked machine positioned on jack-up barge, insert steel casing tubes into riverbed to depth sufficient to achieve stability and a seal to minimise water ingress and contain disturbed silts. The casings are expected to be installed into the glacial till to an estimated total depth below riverbed level of approximately 13m (to be confirmed).

2.8.7 Tubes to be lifted from floating support barge alongside, by crane, and lowered vertically to position, then oscillated or driven in with vibration. Introduce drilling fluid, Polymer or Bentonite to stabilise the ground.

RPW Stage 3 – Rotary Boring and Reinforcement

2.8.8 Using a piling rig positioned on the jack-up barge rotary bore within the steel tubes to remove riverbed silt and underlying glacial till deposits to full pile depth required (approx. 34m below riverbed level (assuming river bed level is at 0m AOD).

2.8.9 Capture arisings from auger rotary bore, eg by temporary structure mounted on each tube, and remove to land, minimising any loss of material into the river. Using crane, lift and insert reinforcement into the bored holes.

RPW Stage 4 – Concrete Placement

2.8.10 Place concrete using a tremie pipe (watertight pipe) to form the piles, pumping off the displaced drilling fluid for recycling. Concrete to be prepared on shore and delivered to the jack-up by pumping. It is anticipated that the piles will be installed in groups of four and that the jack up barge will be moved slightly for each group to maintain an even spread of load from cranes on the deck of the barge.

RPW Stage 5 – Pile Cap and Pier Construction

2.8.11 Install temporary formwork or a precast concrete caisson at the top of piles above river bed level, fix reinforcement and pump concrete to construct a continuous pile cap and piers.

2.8.12 Repeat activities for second river pier.

Earthworks

2.8.13 The Scheme would require new embankments and bridge abutments to be built to achieve the required vertical road alignment for the approaches to the new bridge. The abutments would be set well back from the top of the riverbank to allow for the provision of active travel routes along both banks and retention of riverbanks. Other movements of natural earth and made ground would be needed to construct the

new drainage system, including ditches and swale, and for the construction of new structures. There would also be a requirement for earth movement for initial site clearance e.g. stripping and storing topsoil and for final landscaping throughout the works area.

2.8.14 Topsoil would be stripped using tracked excavators and possibly a dozer in the one agricultural field. It is anticipated that dump trucks would transport material to temporary topsoil stockpile locations where it would be stored no greater than 4m high. Bulk earthmoving operations would typically be carried out using large excavators, articulated dump trucks, dozers and heavy compaction plant. On completion of the earthworks and landscape fill areas, topsoil would be placed and planting carried out in accordance with the specified landscape design. Further works of ecological mitigation would be carried out and a period of establishment and aftercare would be implemented.

2.8.15 Outline plans for environmental protection during earthworks are set out in the Outline Construction Environmental Management Plan which forms Appendix 18.A to the Environmental Statement.

Replacement Bridge Construction

2.8.16 The construction of the replacement bridge would be a complex operation and subject to a detailed works execution plan prepared by the contractor. However, some outline activities are identified below that provide an indication of what construction activities may be required:

a) The Queensferry Drain, River Pumping Station and Outfall will be relocated to a new position to the south and other services within the banks will have been protected or diverted.

b) Excavate down to formation level – install temporary sheet piles to river bank to maintain flood bank level of integrity.

c) Install piles within formation and crop the pile heads to receive abutment.

d) Cast abutment concrete and construct bearings.

e) Backfill the abutment ready for placement of bridge beams.

f) Remove temporary river bank support piles and regrade the river bank.

g) Construct earthwork embankment approaches to new abutments.

h) Construct temporary crane support platform either on or immediately to the rear of the new bridge abutments.

i) Place side-span bridge beams in pairs spanning from abutments to beyond the piers, using crane(s) positioned on each bank.

j) Lift central span beams by crane from barge or from banks, using crane(s) positioned on bank and splice to complete each girder.

k) Fix permanent formwork to beams, place reinforcement and pump concrete to form deck incorporating pre-cast edge beams.

l) Waterproof the new deck with spray-applied bitumen system, apply bitumen-macadam / asphalt carriageway surfacing and lining and install barriers. Install services and street lighting columns.

Road pavement construction

2.8.17 Road pavement construction requires sizeable items of specialist plant, such as paving machines and heavy rollers, and the delivery to site of significant volumes of construction materials such as asphalt. In addition, it is likely that some pavement works will need to be completed at night due to traffic management requirements when tying the new road surface into existing highways.

2.8.18 The installation of road restraint systems, road signs and lighting in the highway verges may be carried out during normal daytime working hours, as some of the last activities in each Section. They are unlikely to have any significant impacts on the local environment.

2.8.19 Road marking may require some night-time working to tie into the existing road network, but this will be localised, of short duration and is unlikely to have any significant impact on the local environment.

2.9 Traffic Management

2.9.1 Traffic management and restrictions would be needed to provide safe access and working areas for the construction workforce and their vehicles, plant and equipment and to permit safe passage of vehicles and non-motorised users, such as pedestrians and cyclists, through and adjacent to the works.

2.9.2 These traffic restrictions must be carefully planned and managed and would include a variety of measures, from separating works areas from public access areas to full closures of certain roads for short durations plus speed restrictions. Ideally the construction programme would be developed, wherever practicable, to avoid the need to have temporary traffic management in place over bank holiday periods. However, major elements of traffic management, such as narrow lanes and significant lengths of solid barrier or cones, would need to remain in place to maintain the safety of the travelling public. In addition, repeated removal and reinstatement of traffic management would result in inefficient and prolonged working, additional surfacing and lining works and confusion for the road user.

2.9.3 Full overnight closures of the A494 may be required for short periods to allow the lifting of bridge beams and other works directly over or alongside the carriageway. These would be planned and publicised well in advance.

2.10 Outline-Construction Environmental Management Plan

2.10.1 An Outline Construction Environmental Management Plan (Outline CEMP) is included in Appendix 18.A in Volume 3. The Outline CEMP sets out how the various construction activities would be managed to comply with the relevant environmental legislation and best practice to minimise effects on residents and environmental receptors. Following publication of the draft Orders and the Public Local Inquiry, the Outline CEMP would be developed into a full CEMP by the contractor, which would be in place before construction begins.

2.10.2 The CEMP is a live document that is developed and updated through the detailed design and construction stages. Development and implementation would be managed throughout by the contractor. The CEMP would ensure that construction activities are planned and managed in accordance with all the environmental requirements identified in the ES.

2.10.3 Compliance with the CEMP would be a mandatory contractual requirement both for the main contractor and for all subcontractors, to ensure that best practice is implemented during construction and to safeguard the environment.

Marine Licence

2.10.4 The River Dee is a tidal estuary and so the construction of the replacement bridge will require that a Marine Licence be obtained from Natural Resources Wales before work below Mean High Water Springs can take place.

Working Hours

2.10.5 The working day would vary between the seasons. However, it would typically be Monday – Friday 0700 to 1900 in the summer months and 0700 to 1700 in the winter. In certain circumstances, specific works may have to be undertaken outside the normal working hours. Night working would also be required in some cases. This would include work to be carried out during limited periods for work requiring lane or carriageway closures, to minimise disruption to road users. These instances would be kept to a minimum and require agreement with the Welsh Government and NMWTRA beforehand.

2.10.6 In river working would be restricted to between 0800 – 1700hrs and no work in 3hr period leading up to high tide at Chester weir as agreed with NRW

2.10.7 Any working outside the normal hours would be agreed with the local authority's Public Protection Officer (or equivalent) and residents would be informed in advance.

Community Liaison

2.10.8 Before commencing construction activities, a Public Liaison Officer (PLO) would be appointed by the contractor for the Scheme. The PLO would be the main direct contact for Community Councils, local planning authorities, residents, businesses and stakeholder groups and would be responsible for managing and implementing the Communication Strategy.

2.10.9 A complaints procedure would be established for the Scheme. The procedure would be managed using a database of incidents, complaints and enquiries. All complaints would be recorded, with the intention of resolving the complaint within

seven days of being reported. The action taken to resolve the complaints would also be recorded.

2.10.10 An Environmental Liaison Group has been established for the Scheme, comprising key stakeholders such as the local authority and Natural Resources Wales. The Group would continue to meet at suitable points during the construction period.

Llywodraeth Cymru / Welsh Government

A494 RIVER DEE BRIDGE REPLACEMENT SCHEME

Environmental Statement

Volume 1: Technical Assessment Report

Chapter 3: Alternatives Considered

395318-RML-00-XX-RP-L-0002

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3. Alternatives Considered

3.1 Introduction

3.1.1 This chapter of the Environmental Statement (ES) outlines the main alternatives considered during the development of the Scheme. It describes the Welsh Trunk Road Appraisal Guidance (WelTAG) stages that have been followed in accordance with Welsh Government requirements and the assessment process for the options and alternatives considered in the Scheme selection process.

3.2 Legal Context

3.2.1 The current EIA Regulations require that an ES should include: -

"A description of the reasonable alternatives studied by the developer, which are relevant to the project and its specific characteristics, and an indication of the main reasons for the option chosen, taking into account the effects of the project on the environment"[1].

3.2.2 This chapter includes an outline account of the main and reasonable alternatives to the Scheme that have been considered by the Welsh Government and its advisors, while undertaking the stages of the WelTAG that considers a wide range of alternatives and options before selecting a preferred Scheme.

[1] The 2011 EIA Directive requires the following to be included within an ES. '*An outline of the main alternatives studied by the developer and an indication of the main reasons for his choice, taking into account environmental effects'* (Article 5, 3(d) Directive 2011/92/EU). Directive 2011/92/EU has been amended by Directive 2014/52/EU. Although the transitional measures in place mean that the provisions of Directive 2011/92/EU remain applicable for the Scheme, the requirements of Directive 2014/52/EU have been considered within this ES, where practicable. Directive 2014/52/EU amends Article 5, 3 as follows. '*A description of the reasonable alternatives studied by the developer, which are relevant to the project and its specific characteristics, and an indication of the main reasons for the option chosen, taking into account the effects of the project on the environment*'. (Article 5, 3(d) Directive 2011/92/EU).

3.3 Welsh Transport Appraisal Guidance – WelTAG

3.3.1 WelTAG is the Welsh Government's guidance on planning and appraising transport interventions. It applies to strategic transport programmes and policies, as well as individual transport projects. It aligns with Llwybr Newydd – The Wales Transport Strategy 2021 and the Well-being of Future Generations (Wales) Act 2015.

3.3.2 New WelTAG guidance was published in 2024 to align with the Wales Transport Strategy and the Welsh Government's Net Zero Strategic Plan[2] that sets carbon reduction targets and budgets for carbon emissions with a target to be net zero by 2030.

3.3.3 WelTAG is composed of five stages.

Stage 0 – Case for Change
Stage 1 – Strategic Outline Case
Stage 2 – Outline Business Case
Stage 3 – Full Business Case
Stage 4 – Delivery
Stage 5 – Monitoring and Evaluation

WelTAG Stage 0 – Case for Change

3.3.4 The River Dee Bridge Replacement project has been through WelTAG Stage 0 as a major asset renewal scheme. The case for the scheme is clear; the bridge carries 68,400 vehicles a day and is a strategic asset on the A494 and a vital component of the strategic road network. The bridge is in poor structural condition and any further deterioration could potentially impact on the wider road network. Inspections and monitoring to date have concluded that the frequency of repairs and the risk of major repair and intervention requiring the closure of the bridge is growing year-on-year. Therefore, the case for change remains strong and the Scheme forms part of the Welsh Government's Major Assets Renewals (MAR) Programme.

[2] Welsh Government's Net Zero Strategic Plan – September 2022

WelTAG Stage 1 - Strategic Outline Case

3.3.5 WelTAG Stage 1 sets out the strategic outline case for the replacement of the A494 River Dee Bridge as part of the Welsh Government's (MAR) Programme. It is well documented that the River Dee Bridge is a strategic component of the wider A494 and strategic road network and an essential artery in sustaining businesses and employment in the local and wider region of North Wales.

3.3.6 WelTAG Stage 1 identified a long list of forty-four options that were sifted based on deliverability to reduce the options to thirty-nine. This long-list of options were appraised against the four road building tests set by the Roads Review Panel as set out below: -

Test 1

3.3.7 To support modal shift and reduce carbon emissions. This is about ensuring that future roads investment does not simply increase the demand for private car travel. Instead, we need to deliver schemes that contribute meaningfully to modal shift, which will require different approaches in different parts of Wales.

Test 2

3.3.8 To improve safety through small-scale changes. Safety on the road network must be paramount. Investments for safety should focus on specific safety issues to be addressed (rather than wider road improvements and increases in road capacity). Speed limits should be considered as one of the primary tools for improving safety.

Test 3

3.3.9 To adapt to the impacts of climate change. Climate change is already having an impact on our road network and is likely to become an increasing issue in future decades. Road investment can be justified to adapt for these circumstances to ensure roads can continue to function and contribute meaningfully to modal shift.

Test 4

3.3.10 To provide access and connectivity to jobs and centres of economic activity in a way that supports modal shift. In particular, new, and existing access roads will be necessary to connect new developments, including Freeports, to the existing network. The location of new developments needs to be consistent with Future Wales / PPW11, which includes the principle of maximising the opportunity of access by sustainable means and should be designed to prevent 'rat-running'.

3.3.11 In developing schemes, the focus should be on minimising carbon emissions, not increasing road capacity, not increasing emissions through higher vehicle speeds and not adversely affecting ecologically valuable sites.[3]

3.3.12 The River Dee is an ecologically valuable site, but in the case of this project, a major asset renewal scheme, there is no reasonable alternative but to cross the river in order to maintain a functional road network that connects the north of England and North Wales, to Holyhead and the new Anglesey Freeport.

3.3.13 The long list of options appraised against the four tests resulted in twelve being progressed. For the options rejected, this was largely based on: -

i) Adverse impacts on the operation of the existing highway network
ii) Potential creation of induced traffic (such as from increased carriageway capacity in the 3+3 lane and 4+4 lane options)
iii) Uplift in operational carbon
iv) Decrease in capacity such as the single carriageway options.

3.3.14 The best performing options that passed through the four road building tests formed the basis for further appraisal against the Scheme objectives. The short-listed options were selected as the following option packages: -

Package B: New twin structure River Dee Bridge plus active travel link within existing rail underbridge.

[3] The Welsh Government's response to a report advising on current road projects and how to consider future projects – 14 February 2023

Package C: New twin structure River Dee Bridge plus separate rail underbridge for active travel.

Package D: New off-line single structure River Dee Bridge plus new westbound rail underbridge.

Package E: New off-line single structure River Dee Bridge plus active travel link within existing rail underbridge.

Package F: New off-line single structure River Dee Bridge plus separate rail underbridge for active travel.

Environmental Factors

3.3.15 The general alignment and land take required for all five of the alternative packages were broadly the same. This was largely due to the physical constraints of having to re-connect to the existing A494 road corridor either side of the River Dee, and for the span of the bridge having to be similar lengths for each option (circa 142 metres). All packages would include the removal of the existing bridge once the replacement bridge scheme is completed.

3.3.16 Packages B and C involve the construction of new twin bridge structures whereas D, E and F are for one single bridge. D, E and F are further away from the residential properties in Queensferry and Garden City and further upstream to the south-east.

3.3.17 All packages are for two lanes of traffic in each direction and as a result are not expected to have a significant change to traffic flows or whole life carbon emissions during the operational life cycle. All packages offer a positive contribution towards modal shift as they include the potential for an enhancement to active travel provision when combined with the complementary options.

3.3.18 Construction of any new structures would inevitably result in carbon disbenefit. The scale of the disbenefit will vary between the packages with the twin-span River Dee options (B and C) likely to involve higher level of carbon. Similarly, the construction of a westbound carriageway at the railway line (option D only) will also produce a higher level of carbon.

3.3.19 Packages B and C both include two new bridges over the River Dee and would require more in river working for piling operations and construction of river piers than Packages D, E and F. While working methods can be designed to reduce certain effects such as noise and vibration, the levels of environmental risk for in river working would be less for D, E and F. There would be a similar net loss of saltmarsh on all packages but more opportunity for recovery of loss in packages D, E and F as the existing bridge would be removed and present opportunities for some natural recolonisation on the north-eastern bank of the river.

3.3.20 The WelTAG Stage 1 assessment recommended that the five option packages be progressed to WelTAG Stage 2 so that a more in-depth technical assessment can be undertaken including technical and environmental considerations.

WelTAG Stage 2 – Outline Business Case

3.3.21 The replacement of the A494 River Dee Bridge (referred onwards as, the 'Scheme') is a part of Welsh Government's Major Asset Renewal Programme for the trunk road network and identified as the second highest priority.

3.3.22 WelTAG Stage 2, the Outline Business Case, narrows down and refines a short-list of potential transport options to the point where a Preferred Option can be determined. It reviews the existing evidence base to demonstrate an option which is aligned with the priorities for transport and wellbeing within Wales.

3.3.23 The findings of the WelTAG Stage 2 have indicated that the Preferred Option should comprise a new single structure bridge across the River Dee, to be constructed off-line. An active travel link will also be provided adjacent to the westbound carriageway, over the river and through the existing railway underbridge which carries the North Wales Main Line across the A494.

3.3.24 Package E was found to perform strongly against the transport and wellbeing criteria outlined in both WelTAG and Welsh Government policy, including the Wales Transport Strategy and Well-being of Future Generations (Wales) Act 2015. It is more affordable than the other short-listed options, has a lower environmental footprint and is the most practical to deliver.

3.3.25 Package E was also found to perform marginally better on delivering Net Benefits to Biodiversity (NBB) in that results in: -

a) A moderate gain in semi-improved neutral grasslands, which increases species-rich environments and enhances biodiversity. The introduction of marsh/marshy grassland, achieving a moderate gain, is particularly noteworthy as it supports wetland species.

b) A slight loss of saltmarsh habitat, while there are challenges associated with the loss of saltmarsh, the emphasis on potential natural succession for habitat restoration underscores a commitment to long-term ecological resilience.

c) An increase in running water, particularly the Queensferry Drain, that shows slight gains by shorter sections being culverted and increased lengths of open channel.

d) A reduction in buildings, structures, and hardstanding, included within this area is the inclusion of a new bat house building, contributing to biodiversity through habitat provision for bats. Spoil and bare ground have a minimal gain reported.

3.4 The Preferred Scheme

3.4.1 Through the WelTAG process it has been found that the best performing option is Option E, and that this option will form the basis of the preferred scheme. Option E has progressed to Key Stage 3 - Detailed Design that incorporates mitigation and enhancement measures that will be delivered as part of the scheme proposals in order to reduce or minimise any adverse environmental effects and provide opportunities to deliver net benefits for biodiversity. This Scheme is the subject of a statutory EIA, the findings of which are reported in this ES.

Llywodraeth Cymru / Welsh Government

A494 RIVER DEE BRIDGE REPLACEMENT SCHEME

Environmental Statement

Volume 1: Technical Assessment Report

Chapter 4: Approach to Environmental Assessment

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4. Approach to Environmental Assessment

4.1 Introduction

4.1.1 This chapter of the Environmental Statement (ES) sets out the approach taken to prepare the Environmental Impact Assessment (EIA). The chapter sets out the overall approach to the assessment of the likely effects of the Scheme and includes details of the consultation undertaken. Further details of topic specific methods, such as survey techniques and assessment methodologies, are provided in each topic chapter of this ES.

4.1.2 This ES provides the information required by the Highways Act 1980 (as amended) together with other relevant information listed in the EIA Directive (as amended). Together, the information supplied within this ES is considered to provide a clear understanding of the main or likely significant effects of the Scheme on the environment.

4.2 Legislative Framework

The Environmental Impact Assessment Regulations 2017

4.2.1 The Environmental Impact Assessment (Miscellaneous Amendments relating to Harbours, Highways and Transport Regulations 2017) 'The Regulations' were enacted to transpose the 2014 Directive[1] for projects under the Highways Act and came into force on 5th December 2017. The main changes made from the Directive include revisions to how screening and scoping are undertaken and the requirements for a Screening Report that sets out the likely significant effects as well as outlining any mitigation measures. New topics are to be considered in the EIA process and that competent experts with sufficient expertise are used in the preparation of the Environmental Statement.

[1] The legislative framework for EIA is set by the EIA Directive (2014/52/EU) that came into force in May 2014

4.2.2 As set out in Chapter 1, there is no statutory provision for the form of an ES. Section 105A (4) of the Highways Act states that the ES must contain the following specified information:

(a) a description of the site, design, size, and any other relevant features of the project

(b) a description of the likely significant effects of the project on the environment.

(c) a description of the features of the project or measures envisaged to avoid, prevent or reduce and, if possible, offset any likely significant effects of the project on the environment.

(d) a description of the reasonable alternatives studied by the project authority which are relevant to the project and its specific characteristics, and an indication of the main reasons for the option chosen, taking into account the effects of the project on the environment,

(e) a non-technical summary of the information mentioned in paragraphs (a) to (d)"[2].

The Conservation of Habitats and Species Regulations 2017

4.2.3 The Conservation of Habitats and Species Regulations 2017 (as amended)[3] ensures the protection of Special Areas of Conservation (SAC's) and Special Protection Areas (SPA's) in the UK. A Habitats Regulations Assessment (HRA) is required for any proposed plan or project which may have a 'Likely Significant Effect' (LSE) on one or more 'protected sites' (these are termed sites within 'national sites network', formerly known as Natura 2000 sites) and which is not necessary for the management of those sites. The River Dee Bridge Replacement Scheme is regarded to be such a project. A separate HRA report has been

[2] Highways Act 1980, as amended, Section 105A
[3] Conservation of Habitats and Species Regulations 2017 (as amended). Available at https://www.legislation.gov.uk/uksi/2017/1012/regulation/1 [Accessed 28/10/24]

undertaken for this project and written in accordance with DMRB guidance LA115 Habitat Regulations Assessment.

4.2.4 The test of Likely Significant Effects (LSE) has identified that likely significant effects on qualifying features of the following protected sites could not be ruled out at this stage, in the absence of appropriate mitigation and taking into consideration their conservation objectives.

a) **River Dee and Bala Lake SAC** – salmon, sea and river lamprey and otter

b) **Dee Estuary SAC –** Atlantic salt meadows, estuaries, mudflats, and sandflats not covered by the sea at low tide, and sea and river lamprey.

c) **Dee Estuary Ramsar –** Waterfowl and wetland bird assemblage, saltmarsh, intertidal mudflats and sandflats and estuary.

d) **Dee Estuary SPA** – All features of interest and sub features saltmarsh, intertidal mudflats and sandflats and estuary.

4.2.5 It is therefore considered necessary for an Appropriate Assessment to be carried out for the A494 River Dee Bridge Replacement Scheme on the qualifying features of these protected sites, in line with DMRB LA 115 guidance.

The Water Environment

4.2.6 An assessment of effects on Water Framework Directive watercourses was undertaken and is provided in Volume 3 Appendix 7 of this ES.

4.3 EIA Screening (Determination)

4.3.1 EIA is an iterative process that occurs alongside a development proposal, in a series of steps that lead up to the reporting of the findings in an ES. The process includes the following sequence: screening (is an EIA required?), scoping (what aspects need to be assessed in the EIA?), assessment and reporting.

4.3.2 An EIA is a means of identifying and collating information to inform an assessment of the likely significant environmental effects of a project. The process requires consideration of the likely changes to the environment, where these arise because

of the proposed development, through comparison with the existing and likely future baseline conditions in the absence of the proposed development.

4.3.3 The requirement to complete a statutory EIA and publish an ES only applies to certain projects that are deemed to exceed certain thresholds and are predicted to have a significant effect on the environment. The process for deciding whether it is necessary to carry out an EIA and publish an ES is called Screening. The screening process is described in DMRB LA 102.

4.3.4 DMRB LA 102 sets out four steps to screening. These are summarised in Table 4-1.

Step	Requirements of screening	Results for this Scheme
1	Does the Project fall within Annex I or II of the EIA Directive?	The Scheme falls outside the Annex I threshold because it would not involve the construction of a motorway or express road of four or more lanes, nor would it constitute a realignment or widening of a two-lane road or less to provide four lanes over a continuous length of 10km.
2	Deciding if the Annex II Project is a 'Relevant Project.'	The Scheme exceeds the Annex II threshold of 1 hectare and is situated within a 'sensitive area' as defined by the EIA Regulations and is therefore an Annex II 'Relevant Project'.
3	The Determination of a 'Relevant Project' for the Purposes of the EIA Regulations.	Based on the criteria set out in Annex III an assessment of the Scheme indicates that the Scheme is considered likely to have significant effects on the environment.
4	Reporting the Determination.	A Record of Determination has been prepared based on the results of the screening assessment.

Table 4-1 The steps to screening a project.

Step	Requirements of screening	Results for this Scheme
1	Does the Project fall within Annex I or II of the EIA Directive?	The Scheme falls outside the Annex I threshold because it would not involve the construction of a motorway or express road of four or more lanes, nor would it constitute a realignment or widening of a two-lane road or less to

Step	Requirements of screening	Results for this Scheme
		provide four lanes over a continuous length of 10km.
2	Deciding if the Annex II Project is a 'Relevant Project.'	The Scheme exceeds the Annex II threshold of 1 hectare and is situated within a 'sensitive area' as defined by the EIA Regulations and is therefore an Annex II 'Relevant Project'.
3	The Determination of a 'Relevant Project' for the Purposes of the EIA Regulations.	Based on the criteria set out in Annex III an assessment of the Scheme indicates that the Scheme is considered likely to have significant effects on the environment.
4	Reporting the Determination.	A Record of Determination has been prepared based on the results of the screening assessment.

The Screening exercise was carried out in 2024 to decide whether the project falls below or above the thresholds stated within the EIA Regulations. The conclusion was that an EIA would be required and that the Project Sponsor (Welsh Government) should be informed that a Record of Determination (RoD) and Notice of Determination should be published alongside this ES, to ensure legal compliance. The draft RoD was submitted to the Project Sponsor (Welsh Government) in March 2025.

4.4 EIA Scoping

4.4.1 The process of identifying the matters to consider within the EIA is known as Scoping. Scoping is an important preliminary procedure which sets the context for the EIA. Because the screening assessment demonstrated that an EIA should be carried out, a scoping assessment was completed. The scoping exercise was undertaken in accordance with DMRB LA 103 **-** Scoping projects for environmental assessment.

4.4.2 The Scoping Report was prepared and issued on 18th December 2024 to the statutory consultees and representatives of other bodies who attend the Environmental Liaison Group (ELG) meetings. The consultees were: -

a) Welsh Government

b) North and mid Wales Trunk Road Agent (NMWTRA)

c) Natural Resources Wales (NRW)

d) Flintshire County Council

e) Cadw

f) Heneb

4.4.3 A copy of the Scoping Report is provided at Appendix 4.A of this ES. The purpose of the Scoping Report was to identify the proposed scope of the EIA process and to set out the proposed assessment methods for comment. Comments were invited to be returned by 17th January 2025. NRW requested an extension of time to consider the contents of the Scoping Report, a revised date of 31st January 2025 was agreed.

4.4.4 The 2024 Scoping Report was prepared for the current Scheme proposal and supersedes a previous Scoping Report prepared for the Dee Bridge Improvement Scheme in 2018.

4.4.5 Table 4.2 provides a summary of the key points raised by consultees during the scoping process and how these have been addressed within this ES. The specialist aspect chapters of this ES also provide a summary of the key points raised during consultation with both statutory and non-statutory consultees.

Table 4-2 Consultation responses

Consultee	Summary of comment on Scoping	How addressed
Natural Resources Wales (31/01/2025)	Detailed comment on coverage of flood risk and flood risk modelling. Flood Risk Activity Permits (FRAP) will be needed at some stage in the project	On going hydraulic flood risk modelling work being progressed in consultation with NRW through DPAS Detailed modelling to be reported in ES Chapter 7 Road Drainage & Water Environment
Natural Resources Wales (31/01/2025)	Water quality and Water Framework Directive (WFD) NRW advise that the ES should include specific sections covering the effects of the proposals on the marine environment and designated features of the Dee Estuary SAC	To be included as a specific section within Chapter 8 Biodiversity
Natural Resources Wales (31/01/2025)	NRW advise the baseline condition should include a baseline description of the River Dee and Dee Estuary hydrodynamics	To be included as a specific section within Chapter 8 Biodiversity
Natural Resources Wales (31/01/2025)	Need to consider potential effects on migratory fish caused by in river piling operations – NRW keen to avoid impacts of noise and vibration	To be considered in constructability and description of the works in ES Chapter 2 The Project
Natural Resources Wales (31/01/2025)	Strongly advise that consideration should be made of the Wealden case law in relation to Air Quality impacts and traffic predictions.	To be covered in ES Chapter 11 Air Quality
Heneb (Clwyd Powys Archaeological Trust) (07/01/2025)	General comments on potential impacts to recorded features. Specific comments on updates to legislation such as the Historic Environment (Wales) Act 2023.	Updates to be included in ES Chapter 10. Cultural Heritage.
Cadw (24/01/2025)	In general agreement with Scoping Report (Chapter 10) – updates to legislation and Technical Advice Note (TAN24)	Updates to be included in ES Chapter 10. Cultural Heritage.

4.5 Structure of the Environmental Statement

4.5.1 Based on the scoping report and the requirements of the Design Manual for Roads and Bridges, the volumes and chapters that make up the content of the ES are set out in Table 4-3.

Table 4-3 Structure of ES

Document or chapter	Subject
Non-technical summary	Summary of the ES using non-technical terminology
Volume 1	**Text**
-	Glossary
Chapter 1	Introduction
Chapter 2	The Project (Description of the Scheme)
Chapter 3	Alternatives considered
Chapter 4	Approach to Environmental Assessment
Chapter 5	Legislation and policy context
Chapter 6	Geology and soils
Chapter 7	Road drainage and water environment
Chapter 8	Biodiversity
Chapter 9	Landscape and visual effects
Chapter 10	Cultural Heritage Assessment
Chapter 11	Air quality
Chapter 12	Noise and vibration
Chapter 13	Material assets and waste
Chapter 14	Population and Human Health
Chapter 15	Climate
Chapter 16	Marine Environment
Chapter 17	Cumulative Effects
Chapter 18	Environmental Management Plans
Chapter 19	Conclusions
Volume 2	**Figures**
Volume 3	**Appendices**

4.6 Environmental Topic Chapters

4.6.1 The assessment of each environmental aspect forms a single chapter within this ES and will contain details of:

a) Legislation and policy relevant to the aspect.

b) Assessment method used.

c) Description of the baseline environmental conditions.

d) Mitigation measures forming part of the Scheme design.

e) Identification of potential effects (including those arising during the construction and operational phases).

f) Identification of mitigation and monitoring measures, where appropriate.

g) Evaluation and assessment of the significance of identified effects.

h) Identification of any associated inter-relationships.

4.6.2 Each aspect chapter provides details of the method for baseline data collection and the approach to the assessment of effects. Each environmental aspect has been considered by a suitably qualified and experienced specialist. The identification and evaluation of effects is based on the information set out in the Scheme description and construction details contained within Chapter 2 of this ES, EIA good practice guidance documents and relevant aspect-specific guidance where available.

4.6.3 Cumulative effects with other proposed developments, and inter-relationships between aspect areas, are assessed within Chapter 17 of this ES.

4.7 Identification of Baseline Conditions

4.7.1 An ES requires sufficient data to form the basis of the assessment. Each aspect chapter includes a description of the current (baseline) environmental conditions. This is based on the study area identified for each aspect chapter. In some instances, more than one study area has been defined in accordance with relevant standards and guidance for that aspect.

4.7.2 Baseline data has been obtained from existing sources (including desk study and previous surveys), from surveys commissioned specifically for the Scheme, or both. The identification of existing baseline conditions has been informed by data from these sources.

4.7.3 The baseline environmental conditions are described in the Environmental Statement for each environmental aspect or factor without the Scheme in place.[4] This provides the baseline conditions against which the effects of the Scheme on a particular environmental factor are assessed. Effects must be assessed and reported by comparing a scenario with the Scheme in place, against one without the Scheme. This is described as the Do-Minimum (without the Scheme in place) compared with the Do-Something i.e. with the preferred option Scheme in place. The proposed Scheme is described in Chapter 2 'The Project' of this ES and with drawings in Volume 2 Figures.

4.7.4 The Do Minimum scenario is the baseline scenario plus an outline of the likely scenario predicted on the availability of environmental information and scientific knowledge, without the proposed Scheme. In the case of the A494 Dee Bridge Replacement Scheme, the Do Minimum scenario is complex and difficult to clearly define. This is primarily due to the ongoing deterioration of the structural condition of the bridge. For most of the environmental aspects or factors, the Do Minimum scenario, is that the River Dee Bridge remains open to traffic with ongoing repairs. A scenario where the bridge needs to be completely closed and traffic diverted has been considered but for the purposes of this environmental assessment, has been dismissed as an unlikely event. This is one of the main uncertainties of the environmental assessment that cannot be supported by evidence.

4.7.5 Each aspect chapter identifies the limitations of the assessment and whether there were any constraints encountered in compiling the information that is presented in this ES.

[4] DMRB – LA 104 para 3.10

4.8 Environmental Assessment Methodology

Relevant EIA Guidance

4.8.1 The EIA has been undertaken in accordance with the guidance set out in DMRB LA 104 Environmental assessment and monitoring[5] that aligns with the requirements of the EIA Regulations 2017.

4.8.2 LA 104 provides guidance on the determination of significant effects for highway schemes. This includes the consideration of the EIA criteria:

a) Assigning environmental value (or sensitivity) of a resource or receptor

b) Assigning magnitude or degree of impact.

c) Assigning significance

d) Cumulative Effects

Assigning Value or Sensitivity

4.8.3 'Receptors' are defined as individual environmental features that have the potential to be affected by a project. For each aspect, baseline studies have guided the identification of potential environmental receptors. Some receptors will be more sensitive to certain environmental effects than others. The sensitivity or value of a receptor may depend, for example, on its frequency, extent of occurrence or conservation status at an international, national, regional, or local level.

4.8.4 Sensitivity is defined within each ES aspect chapter and considers factors including the following:

a) Vulnerability of the receptor to change.

b) Recoverability of the receptor (ability to recover from a temporary impact).

c) Importance of the receptor.

[5] LA 104 Environmental assessment and monitoring – August 2020

4.8.5 As a general guide, the definitions set out in Table 3.2N of LA 104 have been considered (except where aspect guidance requires otherwise). This includes a five-point scale for assigning environmental sensitivity as shown in Table 4-4.

Table 4-4 Table Environmental value (or sensitivity) and typical descriptors

Value (sensitivity)	Typical Descriptors
Very High	Very high importance and rarity, international scale, and very limited potential for substitution.
High	High importance and rarity, national scale, and limited potential for substitution.
Medium	High or medium importance and rarity, regional scale, limited potential for substitution.
Low (or lower)	Low or medium importance and rarity, local scale.
Negligible	Very low importance and rarity, local scale.

Magnitude of Impact

4.8.6 Magnitude can be defined as an impact or change caused by one or more aspects of the Scheme; for example, a typical impact would be site clearance of and habitat loss as a result of site clearance of land needed for the construction of the Scheme.

4.8.7 The categorisation of the magnitude of impact is topic specific but generally considers factors such as:

a) Extent (Area and distance)

b) Duration (how long a time will it last)

c) Frequency (how often will it occur)

d) Reversibility (will the effect be undone or repaired)

4.8.8 The definitions set out in Table 3.4N of LA 104 includes a five-point scale for assigning magnitude as shown in Table 4-5.

Table 4-5 The five-point scale for assigning impact magnitude.

Magnitude of Impact	Typical Descriptors
Major	**Adverse:** loss of resource and/or quality and integrity of resource; severe damage to key characteristics, features, or elements.
	Beneficial: large scale or major improvement of resource quality, extensive restoration, or enhancement; major improvement of attribute quality
Moderate	**Adverse**: loss of resource but not adversely affecting integrity; partial loss or damage to key characteristics, features, or elements.
	Beneficial to, or addition of key characteristics, features, or elements; improvement of attribute quality.
Minor	**Adverse:** some measurable change in attributes, quality, or vulnerability; minor loss of, or alteration to, key characteristics, features, or elements.
	Beneficial: minor benefit to or addition of one or more key characteristics, features, or elements; some beneficial impact on attribute, or a reduced risk of negative impact occurring.
Negligible	**Adverse:** very minor loss or detrimental alteration to one or more characteristics, features, or elements.
	Beneficial: very minor benefit or positive addition of one or more characteristics, features, or elements.
No change	**Adverse/beneficial:** no loss or alteration of characteristics, features or elements, no observable impact in either direction.

Assessment of Significance Effects

4.8.9 The approach to assigning the significance of an effect relies on professional judgement of the competent expert or environmental topic specialist. Assigning each effect to one of the five significance categories is intended to enable different topic issues to be placed upon the same scale.

4.8.10 The definition of 'Effect' in DMRB is, a '*term used to express the consequence of an impact (expressed as 'significance of effect').* An '*effect*' is therefore the consequence of an impact (expressed as the '*significance of effect'*). This is identified by considering the magnitude of the impact and the sensitivity or value of the receptor.

4.8.11 The magnitude of impact on a receptor is combined with the sensitivity of that receptor to determine the significance of effect (see Table 4-6). For example, a significant effect may arise because of a relatively modest impact on a resource of national value / sensitivity, or a large impact on a resource of local value / sensitivity. In broad terms, therefore, the significance of the effect can depend on both the impact magnitude and the value or sensitivity or importance of the receptor.

Table 4-6 Significance of Effect

		Magnitude of Impact (degree of change)				
		No change	Negligible	Minor	Moderate	Major
Environmental Value (sensitivity)	Very high	Neutral	Slight	Moderate or large	Large or very large	Very large
	High	Neutral	Slight	Slight or moderate	Moderate or large	Large or very large
	Medium	Neutral	Neutral or slight	Slight	Moderate	Moderate or large
	Low	Neutral	Neutral or slight	Neutral or slight	Slight	Slight or moderate
	Negligible	Neutral	Neutral	Neutral or slight	Neutral or slight	Slight

4.8.12 Each chapter defines the approach taken to the assessment of significance. Where appropriate, aspect chapters have adopted the general approach set out in DMRB LA 104. The evaluation of significance for each aspect will consider industry and professional guidance; codes of practice; policy objectives regulations or standards; advice from statutory consultees and other stakeholders, as well as expert judgement of the EIA practitioners, based on specialist experience. For some aspects, a simplified or quantitative approach is considered appropriate.

4.8.13 Where more than one significance level is provided, professional judgement has been used to determine the significance of effect. Very Large, Large, Moderate or Slight effects may be beneficial or adverse.

4.8.14 Except where guidance requires otherwise, the significance of effect is described using the terms very large, large, moderate, slight, and neutral.

4.8.15 In the EIA Regulations, 'Significant Effects' are generally those that are found to be 'Moderate', 'Large' or 'Very Large', in accordance with Table 4-6. It should be noted however that a significant effect in EIA terms simply means that the effect should be given careful consideration in the decision-making process.

4.9 Assessment of Cumulative Effects

4.9.1 EIA Regulations, as amended, require the EIA to consider cumulative effects. Cumulative effects result from multiple actions on receptors and resources over time and are generally additive or interactive (synergistic) in nature. Cumulative impacts can also be considered as: *'…impacts resulting from incremental changes caused by other past, present or reasonably foreseeable actions together with the project*.'[6]

4.9.2 For ease of reference, this EIA uses the following, simplified definition of 'Cumulative effect'[7]:

4.9.3 There are two types of cumulative effect: -

a) **Intra-project effects:** these occur where a single receptor is affected by more than one type of effect arising from different aspects of the same Project. An example of an intra-project effect would be where a local resident might be shown to experience the effects of construction noise, while also being affected by dust and local traffic disruption. The result would be a greater combined nuisance than each individual effect alone. This assessment is

[6] European Commission, 1999.
[7] Page 115 'Environmental impact assessment handbook. A practical guide for planners, developers and communities

reported under the *intra-relationship* assessments – a review of the conclusions reached as part of the ES specialist topic chapter.

b) **in-combination effects:** these effects occur because of several past, present, or reasonably foreseeable proposed developments, which individually might not be significant, but when considered together could result in significant cumulative effects on a shared receptor and could include developments separate from and related to the Project. This assessment is reported under the '*other developments'* [8] and their potential for 'in-combination effects to occur.

4.9.4 Current government advice[9] confirms that a 'range of public sector and industry guidance is available, but there is no single industry standard for cumulative effect assessment (CEA). The approach undertaken will vary between applications.

4.9.5 In preparing this chapter of the ES, reliance is placed on a '*staged process'* that acknowledges CEA principles:

- Developing existing good practices, methods, and techniques
- Professional judgement and expert opinion
- Knowledge of the project
- Presentation of the outcome

4.9.6 Guidance from the Design Manual for Roads and Bridges (DMRB) LA 104 has also been used to inform the assessment process. LA 104 requires that the assessment of cumulative effects shall:

a) establish the zone of influence of the project together with other projects.
b) establish a list of projects which have the potential to result in cumulative impacts; and
c) obtain further information and detail on the list of identified projects to support further assessment.

4.9.7 The cumulative effects of the Scheme, in conjunction with other proposed developments, have been assessed and the findings are presented within Chapter 16 of this ES.

[8] As defined
[9] https://www.gov.uk/guidance/nationally-significant-infrastructure-projects-advice-on-cumulative-effects-assessment

4.10 Interrelationships

4.10.1 Consideration of interrelationships is a requirement of the EIA Regulations. Interrelationships refer to the combined effect on individual (or groups of) receptors or resources from more than one source or type of environmental effect (e.g. noise, loss of amenity, visual impact on a dwelling) arising from the Scheme. An assessment of *'Interrelationships'* is covered within each ES chapter. A review of each ES chapter's '*Interrelationships*' assessment is included in Chapter 16.

4.11 Consultations

4.11.1 This section summarises the consultation undertaken with stakeholders during the development of the Scheme and the EIA process. Further details of the comments received (where relevant to the EIA process) are set out within each aspect chapter of this ES.

4.11.2 During development of the Scheme, consultation has been undertaken with, or information requested from, several organisations including (but not limited to) Statutory and non-statutory consultees, interest groups, commercial, industrial, and business operators, and the public (mainly the local community of Queensferry and surrounding communities).

4.11.3 Key stakeholders including statutory consultees and those with a particular stake or significant interest in transport issues relevant to the economy, environment and society in North-East Wales were consulted via Stakeholder Workshops and further direct consultation.

Public Consultation Exercise

4.11.4 Public consultation took place over 12 weeks from the 9 December 2024. Stakeholders demonstrated strong support for replacing the A494 River Dee Bridge as soon as possible. There was support for Option E as a solution which would minimise impacts during construction, provide noise screening for residents, new green spaces for amenity and biodiversity and active travel connections across the River Dee. Option E was confirmed as the Preferred Option by the Cabinet Secretary for Transport and North Wales on 6 June 2025.

4.11.5 The Public Consultation Exhibition Report sets out in more detail the consultation process.

Environmental Liaison Group (ELG)

4.11.6 An integral part of the consultation process are the Environmental Liaison Group meetings. These were held with key environmental consultees during the evolution of the Scheme design and to establish the proposed scope and level of detail required for the draft assessments. Those who attended were invited to comment on the Scheme Objectives and Environmental Objectives, the EIA Scoping Report (see Appendix 4A) and to consider the early findings of this EIA.

Llywodraeth Cymru
Welsh Government

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A494 RIVER DEE BRIDGE REPLACEMENT SCHEME

Environmental Statement

Volume 1: Technical Assessment Report

Chapter 5: Legislation and Policy Context

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5. Legislation and Policy Context

5.1 Introduction

5.1.1 The purpose of this chapter is to provide the overarching and strategic legislative and policy context for the Scheme from an environmental perspective, with reference to relevant strategies and planning policies at a national and local level in Wales.

5.1.2 The Scheme will be developed and delivered following the procedures under the Highways Act 1980 (as amended). Due consideration will also be given to legislation, at a National and local level in the decision-making process. This chapter refers to planning policies and other relevant plans and strategies set at a National level by Welsh Government.

5.1.3 Due consideration will also be given to the development planning policies at the local level. The Scheme falls entirely within the jurisdiction of Flintshire County Council (FCC) as the Local Planning Authority (LPA) and therefore the relevant policies of Flintshire Local Development Plan 2015-2030 that was adopted on 24/01/2023.

5.1.4 Specific legislation and policy are considered further on a topic-by-topic basis within the individual chapters of this Environmental Statement (ES). Individual chapters also provide further detail on how the design of the Scheme has been developed by consideration of the relevant policies.

5.2 Legislation

Highways Act 1980

5.2.1 The Scheme is being promoted and would be (subject to receiving consent) constructed using the powers of the Welsh Ministers as the Highway Authority in accordance with the Highways Act 1980 (as amended). These powers were transferred to them by virtue of the National Assembly for Wales (Transfer of Functions) Order 1999 and the Government of Wales Act 2006.

5.2.2 The powers for Welsh Ministers to replace the existing bridge and improve the A494 road corridor on the approaches to the bridge are obtained through the Statutory Orders process. The draft Orders are published alongside the Environmental Statement. A Compulsory Purchase Order is required to enable Welsh Ministers to acquire all land and rights over land necessary for the construction and operation of the proposals.

5.2.3 As part of the legal process, the Welsh Ministers would consider all the responses to the proposed Scheme and draft Orders and then decide whether to hold a Public Local Inquiry. A Public Local Inquiry would allow a public examination of the draft Orders and proposed scheme.

Environment (Wales) Act 2016

5.2.4 Enacted by the National Assembly for Wales, the Environment (Wales) Act 2016 provides an iterative framework that ensures the sustainable management of natural resources will be a core consideration in the decision-making process. Natural Resources Wales (NRW) are the principal statutory body responsible for delivering the aims of the Act. They are also required to prepare documents including:

a) State of Natural Resources Report (SoNaRR).
b) The Natural Resources Policy (NRP).
c) Area Statements.

5.2.5 These documents will help inform the promoters and designers of developments, such as new road schemes, so that they can consider sustainability of natural

resources in construction and operation of schemes. The Act also includes provisions to tackle climate change, through statutory emission reduction targets and carbon budgeting to support their delivery.

5.2.6 The Act supersedes the biodiversity duty outlined in Section 40 of the Natural Environment and Rural Communities (NERC) Act 2006. Section 6 under Part 1 of the Act introduced an enhanced duty (the S6 duty) for public authorities that exercise their functions in relation to Wales have a duty to maintain and enhance biodiversity and promote the resilience of ecosystems. To follow the S6 duty, public authorities should embed the consideration of biodiversity and ecosystems into their early thinking and business planning, including any policies, plans, programmes and projects, as well as their daily activities.

The Historic Environment (Wales) Act 2023

5.2.7 The Historic Environment (Wales) Act provides the legislative framework for protection to listed buildings and scheduled monuments, enhances existing mechanisms for the sustainable management of the historic environment, and introduces greater transparency and accountability into decisions taken on the historic environment.

5.2.8 The 2023 Act introduced secondary and consolidated legislation that came into full effect on 4th November 2024. It introduces orderly and accessible law for the effective protection and management of the historic environment so that it can continue to contribute to the well-being of Wales and its people.

Well-being of Future Generations (Wales) Act 2015

5.2.9 This 2015 Act is about '*improving the social, economic, environmental and cultural well-being of* Wales' with an overarching aim '*to create a Wales we all want to live in, now and in the future.*'[1] The Act puts in place seven well-being goals shown in Table 5-1.

[1] Well-being of Future Generations (Wales) Act 2015 The Essentials 2nd Ed. May 2015 at gweddill.gov.wales/docs/dsjlg/publications/150623-guide-to-the-fg-act-en.pdf

5.2.10 The 2015 Act places a duty on public bodies in Wales and those listed in the Act to work to improve the economic, social, environmental and cultural well-being of the country. To help do this they must set out and publish well-being objectives and give greater emphasis and consideration to the long term, work and collaborate better with people, communities, and each other, and look to prevent problems and take a more joined-up approach.

Table 5.1: The Seven Well Being Goals

Goal	Well Being Goal
1. A prosperous Wales.	An innovative, productive and low carbon society which recognises the limits of the global environment and therefore uses resources efficiently and proportionately (including acting on climate change); and which develops a skilled and well-educated population in an economy which generates wealth and provides employment opportunities, allowing people to take advantage of the wealth generated through securing decent work
2. A resilient Wales.	A nation which maintains and enhances a biodiverse natural environment with healthy functioning ecosystems that support social, economic and ecological resilience and the capacity to adapt to change (for example climate change).
3. A healthier Wales.	A society in which people's physical and mental well-being is maximised and in which choices and behaviours that benefit future health are understood.
4. A more equal Wales.	A society that enables people to fulfil their potential no matter what their background or circumstances (including their socio-economic background and circumstances).
5. A Wales of cohesive communities.	Attractive, viable, safe and well-connected communities.
6. A Wales of vibrant culture and thriving Welsh Language.	A society that promotes and protects culture, heritage and the Welsh language and which encourages people to participate in the arts, sports, and recreation.
7. A globally responsible Wales.	A nation which, when doing anything to improve the economic, social, environmental and cultural well-being of Wales, takes account of whether doing such a thing may make a positive contribution to global well-being.

Active Travel (Wales) Act 2013

5.2.11 Enacted in 2013 by the National Assembly for Wales, the Active Travel (Wales) Act 2013 sets out a legal requirement for local authorities in Wales to map and plan for suitable routes for active travel, and to build and improve their infrastructure for walking and cycling every year. It creates new duties for highways authorities to consider the needs of walkers, cyclists and other non-motorised users ('NMUs') and make better provision for them. It also requires both the Welsh Government and local authorities to encourage modal shift and promote walking and cycling as a mode of transport so that local communities rely less on cars when making short journeys.

5.2.12 In the context of road schemes, there is significant opportunity to reconfigure existing infrastructure so that it better meets the needs of existing and new settlements and facilitates active travel. For example, road schemes can address settlement severance and, in doing so, provide opportunities for active travel because pedestrians and cyclists would no longer need to compete with significant volumes of vehicular traffic for utility journeys to work and community facilities in the neighbourhood.

5.2.13 The Act requires the Welsh Ministers and local authorities to consider the performance of their functions under the Highways Act 1980 to take reasonable steps to enhance the provision made for walkers and cyclists and to have regard to the needs of NMUs and to promote active travel journeys and secure new and improved active travel routes and related facilities.

Human Rights Act 1998

5.2.14 The Human Rights Act 1998 is relevant where there is a need for compulsory purchase to acquire the necessary minimum land to construct a scheme. The Act outlines that a scheme promoter, such as Welsh Ministers, can make a Compulsory Purchase Order (CPO) where there is a compelling case in the public interest. The acquiring authority should be sure that the purposes for which it is making a CPO sufficiently justify interfering with the human rights of those with an interest in the land affected having regard, in particular, to the provision of Article 1 of The First

Protocol to the European Convention on Human Rights and, in the case of dwellings, Article 8 of the Convention. Article 8 outlines situations of suitable public interference in land ownership which include public safety and the economic well-being of the country.

Climate Change Act 2008

5.2.15 The Act imposes a duty on the Secretary of State to reduce UK wide greenhouse gas emissions in 2050 to a level which is at least 80% below the level of emissions in 1990. It also obliges the Secretary of State to set carbon budgets for successive five-year periods and to prepare proposals and policies for meeting those carbon budgets.

5.2.16 Part 2 of the Act establishes the Committee on Climate Change. Parts 4 and 5 impose limited duties and confer limited powers on Welsh Ministers in terms of contributing towards meeting the UK wide carbon targets. The Environment (Wales) Act 2016 imposes specific carbon budgeting duties on Welsh Ministers like those to which the Secretary of State is subject.

5.3 Welsh Government Plans and Strategies

Net Zero Strategic Plan 2022

5.3.1 The Welsh Government has a central role in addressing the climate emergency in Wales. The Net Zero Strategic Plan sets out 54 initiatives that will be assessed and reviewed in 2025 and 2030. These ambitious initiatives and targets rely on increasing efficiencies, keeping materials in use and avoiding waste, investing in decarbonising buildings and vehicles, and changing the way people behave so that low carbon becomes the default choice in every action people take.

National Transport Delivery Plan for Wales (2022 to 2027)

5.3.2 Published in 2023 by the Welsh Government the National Transport Delivery Plan for Wales[2] sets out how Welsh Government will deliver against the priorities and

[2] https://gov.wales/national-transport-finance-plan-2017-update

ambitions set out in Llwybr Newydd – The Wales Transport Strategy 2021 (WTS). This includes the programmes, projects and new policies that we are intending to deliver over the next five years.

5.3.3 How Welsh Government deliver against the WTS has social, economic, environmental and cultural implications for people in Wales and can help deliver against multiple objectives. Therefore, delivering the WTS is closely aligned with the Programme for Government, Net Zero Wales and links to other government policies such as regeneration and tackling poverty.

5.3.4 The plan lists the schemes the Welsh Government will deliver across the different areas of transport policy for which it is responsible. The Plan is not a policy document but provides a framework of schemes pursuant to policy aims.

Llwybr Newydd: the Wales Transport Strategy 2021

5.3.5 Llwybr Newydd – the Wales Transport Strategy (WTS), published in 2021, identifies three priorities to make the change to a more sustainable transport to meet climate change targets. The three priorities aim to improve health, tackle poverty and open the transport system to all, particularly for those without access to a car and those living in rural areas. The three priorities are set out as follows:

Priority 1: Bring services to people to reduce the need for travel.

Priority 2: Allow people and goods to move easily from door to door by accessible, sustainable transport.

Priority 3: Encourage people to make the change to more sustainable transport.

5.3.6 The A494 River Dee Replacement Scheme fulfils the WTS short term Priority for Roads to '*Maintain and operate the Strategic Road Network in a way that meets our strategy obligations, minimizes environmental impacts, promotes active travel, sustains and creates employment and reduces the backlog of maintenance'*.

5.3.7 The Scheme is primarily a replacement scheme to deal with the life expired existing River Dee bridge. The scheme fits that ambition to support the economy and to support key economic sectors. The alternatives to the preferred scheme are no bridge, or a like for like replacement.

Llwybr Newydd i Natur - the Nature Recovery Action Plan for our Strategic Road Network (October 2023)

5.3.8 Welsh Ministers are directly responsible for the operation, maintenance and improvement of the trunk road and motorway network of Wales, collectively known as the Strategic Road Network. Llwybr Newydd: the Wales Transport Strategy commits Welsh Government to "…*maintain and enhance biodiversity and increase ecosystem resilience through transport operations and infrastructure projects*."

5.3.9 Llwybr Newydd i Natur has been developed to support the Wales Transport Strategy, setting out the actions Welsh Government will take to deliver its ambitions, priorities and commitments. The actions presented in Llwybr Newydd i Natur will also enact the biodiversity and ecosystem resilience recommendations made by the Roads Review Panel in their advice on The Future of Road Investment in Wales. The environmental objectives for the Scheme have been developed to align with Llwybr Newydd i Natur.

The Future of Road Investment in Wales (August 2022).

5.3.10 In June 2021, the Deputy Minister for Climate Change, Lee Waters MS, announced Welsh Government's intention to pause road construction and appoint a Roads Review Panel to review road schemes that were already under development against the new policy commitments made in the Wales Transport Strategy in March 2021, the Programme for Government in July 2021, and Net Zero Wales in October 2021.

5.3.11 At that time, the River Dee Bridge Scheme was under development, but was not part of the roads review as it was categorised as an asset renewal scheme. However, work on progressing the Scheme through the statutory process was halted so that the scheme options could be fully considered against the four road building tests set out by the road review panel namely: -

Test 1 – To support model shift and reduce carbon emissions.

Test 2 – To improve safety through small scale changes.

Test 3 – To adapt to the impacts of climate change.

Test 4 – To provide access and connectivity to jobs and centres of economic activity in a way that supports modal shift.

5.3.12 The assessment of the Scheme options against the road building tests were undertaken in accordance with WelTAG and are presented in Appendix 3 of the WelTAG Stage 1 – Strategic Outline Case (September 2024).

Future Wales: The National Plan 2040

5.3.13 The National Development Framework (NDF) was the draft 20-year national spatial strategy, which Welsh Government were preparing to replace the Wales Spatial Plan. It is required by the *Planning (Wales) Act 2015* and must be reviewed at least every five years. The draft is superseded by the '*Future Wales: The National Plan 2040'*.

5.3.14 Future Wales is intended to set the direction for development in Wales to 2040, '*It is a development plan with a strategy for addressing key national priorities through the planning system, including sustaining and developing a vibrant economy, achieving decarbonisation and climate resilience-, developing strong ecosystems and improving the health and well-being of our communities*[3].

5.3.15 Having set out national policies the plan provides regional approaches. For North Wales it acknowledges that there are a range of strategic issues. Specific to the Wrexham and Deeside National Growth Area, Policy 20 states that the area '*will be the main focus for growth and investment in the North region. Strategic and Local Development Plans across the region must recognise the National Growth Area as the focus for strategic economic and housing growth; essential services and facilities; advanced manufacturing and transport infrastructure. The Welsh Government will work with regional bodies and local authorities in the region and in neighbouring regions of England to promote and enhance Wrexham and Deeside's strategic role and ensure key investment decisions support places in the National Growth Area and the wider region*.'[4]

[3] Future Wales – the National Plan 2040 Introduction page 6
[4] Future Wales – the National Plan 2040 Policy 20 – page 112

5.4 National Planning Policy

Planning Policy Wales, Edition 12

5.4.1 Published by the Welsh Government, Planning Policy Wales (PPW) is the principal and authoritative source of national planning policy, under which local planning authorities prepare their Local Development Plans. The latest edition of PPW (Edition 12) was published in February 2024. It is supplemented by a series of Technical Advice Notes (TANs), Welsh Government Circulars, and policy clarification letters, which together with PPW provide the national planning policy framework for Wales.

5.4.2 The primary objective of PPW is to ensure that the planning system contributes towards the delivery of sustainable development and improves the social, economic, environmental and cultural well-being of Wales, in accordance with the Well Being of Future Generations Act. The document stresses the need for:

5.4.3 Placemaking, an '*holistic approach to the planning and design of development and spaces, focused on positive outcomes*.

a) Strategic and spatial choices
b) Active and social places
c) Productive and Enterprising Places
d) Distinctive and natural places

North Wales Regional Transport Delivery Plan (Draft)

5.4.4 This draft document is intended to supersede the North Wales Joint Local Transport Plan and sets out transport plans for the region between 2025 and 2030. Produced by the North Wales local authorities for transport matters within their jurisdiction, the plan is intended to be complementary to the work of the Welsh Government on trunk roads such as the A494. The regional schemes listed in the plan include a number intended to support public transport, the active travel network and localised highways works to create a more integrated system. The plan seeks to remove barriers to economic growth by:

a) improving connections to employment and strategic links to national and international markets.

b) providing affordable and accessible transport to jobs and services with a focus on the most deprived communities.

c) seeking to address the issues faced in rural communities with improvements to the County Road network and walking and cycling connections, together with infrastructure to support public and community transport.

5.5 Local Planning Policy

Flintshire Unitary Development Plan 2025 to 2030

5.5.1 Flintshire Unitary Development Plan (FUDP)[5] was adopted by the Council on 24th January 2023 for the period 2015 to 2030. The previous plan was time expired before the current plan was adopted. The aim of the FUDP is to provide a framework for making rational and consistent decisions on planning applications and to guide development to appropriate locations. This identifies sites where new housing, employment and other development can take place, as well as setting out policies to protect important countryside, habitats, resources and heritage. The LDP focuses on delivering sustainable development in the County for the remaining years up to 2030. The Council consulted upon the Deposit Plan in September 2019.

5.5.2 Under Policy PC10 New Transport Schemes[6] the county has indicated support for improvements to the primary road network and has safeguarded schemes on the proposals maps. These include A494 Improvements Ewloe to River Dee– '*In order to ensure improvements by Welsh Government to the existing bridge which carries the A494(T) over the R. Dee, land is safeguarded on the proposals maps in the form of a preferred route. In the UDP land was safeguarded from Drome Corner to Ewloe, although only a small section from the Queensferry Interchange northwards to the R. Dee has been carried over to be safeguarded in this Plan'*.

[5] Flintshire Unitary Development Plan (FUDP) (http://www.flintshire.gov.uk/en/Resident/Planning/Development-plans--policies.aspx)
[6] FUDP page 118.

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A494 RIVER DEE BRIDGE REPLACEMENT SCHEME

Environmental Statement

Volume 1: Technical Assessment Report

Chapter 6: Geology and Soils

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6. Geology and Soils

6.1 Introduction

6.1.1 This chapter considers an assessment of the potential likely significant effects of the proposed A494 River Dee Bridge Scheme (hereafter referred to as 'the Scheme') on geology and soils. The assessment also considers potential effects on the Scheme from any contaminated land that may be present and considers the potential for the Scheme to introduce new contaminant linkages that were otherwise not present.

6.1.2 The Scheme has the potential to cause both adverse and beneficial effects. The geology and soils topic encompasses three sub-topics:

a) Geology, which is concerned with the Scheme's effect on designated geological sites (statutory or non-statutory).

b) Contamination, which is concerned with risks to human health and controlled waters from the disturbance of historical contamination and the introduction of new substantial sources of contamination.

c) Soils, which is concerned with the quality of soils as a resource and the Scheme's effect on agricultural land classified as grade 1, 2 or 3a best and most versatile (BMV) or Agricultural Land Classification (ALC) grade 4 or 5 agricultural land.

6.1.3 The effects on groundwater and surface water are considered in relation to contaminated land only. Hydrological effects are assessed in Chapter 7 Road Drainage and Water Environment.

6.1.4 The effects on mineral resources present and materials to be imported and exported in relation to earthworks construction will be assessed in Chapter 13 Material assets and waste

6.1.5 The effects of the proposed Scheme upon agricultural land holdings will be assessed in Chapter 14 (Population and Human Health) and therefore are not considered in this chapter.

This assessment has been undertaken in accordance with the Design Manual for Roads and Bridges (DMRB) LA 109 Geology and Soils[1]. Potential effects relating to contaminated land have been assessed in accordance with the Environment Agency's Land Contamination Risk Management (LCRM) guidance[2].

6.2 Legislation and Policy Framework

National legislation

6.2.1 Land contamination is managed under the Town and Country Planning Act 1990 (as amended). This Act requires that during any development land contamination is considered and managed such that the land is rendered suitable for the use planned and that following development the land cannot be determined as "contaminated land" under Part 2A of the Environmental Protection Act 1990 (EPA'90) [3].

6.2.2 Part 2A of (EPA 1990) provides a means of dealing with previously contaminated land where individual historical source – pathway – receptor linkages are assessed as presenting a Significant Possibility of Significant Harm or a Significant Possibility of Significant Pollution to Controlled Waters representing an unacceptable level of contamination risk. Where a site is considered to present unacceptable risks Part 2A of EPA'90 can be used to require the remediation of the site such that the pollutant linkages are broken.

6.2.3 The Contaminated Land (Wales) Regulations 2006[4] (as amended) set out provisions relating to the identification and remediation of contaminated land under Part 2A of the EPA. The Regulations make provision for an additional description of contaminated land that is required to be designated as a special site where Natural Resources Wales is to be the enforcing authority.

[1] Design Manual for Roads and Bridges LA 109 Geology and Soils. Revision 0, 2019. Available at: LA 109 - Geology and soils (standardsforhighways.co.uk). [Accessed 31/01/ 2025]
[2] Environment Agency. Land Contamination Risk Management (LCRM), 2023. Available at: Land contamination risk management (LCRM) - GOV.UK [Accessed 10/02/2025]
[3] Environmental Protection Act 1990. Available at: Environmental Protection Act 1990 [Accessed: 10/02/2025]
[4] The Contaminated Land (Wales) Regulations 2006. Available at: The Contaminated Land (England) Regulations 2006 [Accessed 10/02/2025]

6.2.4 The Environmental Permitting Regulations 2016 (as amended)[5], regulate pollution control by requiring permits for emissions to, for example, air and water. These Regulations also regulate water discharges through the requirement for a water discharge permit.

6.2.5 The Environmental Damage (Prevention and Remediation) (Wales) Regulations 2009[6] place a legal duty to immediately notify regulators of pollution incidents and to prevent damage to the environment.

6.2.6 The Wildlife and Countryside Act 1981[7] recognises geological and geomorphological features considered to be of national importance which are designated as Sites of Special Scientific Interest (SSSI). The importance of nature conservation, including areas with geological features, is emphasised.

6.2.7 The Water Environment Regulations 2017[8], aims to protect inland and coastal waters and prevent deterioration of aquatic ecosystems, including groundwaters. A key aim of the Water Framework Directive (WFD) is to achieve 'good' ecological status for all waterbodies by 2015, with a secondary aim to gradually reduce the release of pollutants which may pose significant risks to the aquatic ecosystems. The environmental objectives for the WFD are implemented through actions described in the River Basin Management Plans (RBMPs).

6.2.8 The Groundwater (England and Wales) Regulations (2009) [9] are designed to prevent and control groundwater pollution and establish groundwater quality standards.

[5] The Environmental Permitting (England and Wales) Regulations 2016. Available at: The Environmental Permitting (England and Wales) Regulations 2016 [Accessed 10/02/2025]
[6] The Environmental Damage (Prevention and Remediation) (Wales) Regulations 2009. Available at: The Environmental Damage (Prevention and Remediation) (Wales) Regulations 2009 [Accessed 10/02/2025]
[7] Wildlife and Countryside Act 1981. Available at: Wildlife and Countryside Act 1981 [Accessed 10/02/2025]
[8] The Water Environment (Water Framework Directive) (England and Wales) Regulations 2017. Available at: The Water Environment (Water Framework Directive) (England and Wales) Regulations 2017 [Accessed 10/02/2025].
[9] The Groundwater Regulations 2009. Available at: https://www.legislation.gov.uk/ukdsi/2009/9780111480816/contents [Accessed 10/02/2025].

6.2.9 The Water Framework Directive (Standards and Classification) Directions (England and Wales) 2015 sets out environmental quality standards (EQS) for surface water, for priority substances.

6.2.10 The Water Resources Act (WRA) 1991[10] is the primary piece of legislation for the protection of water resources. Risks from historical groundwater pollution can be considered under Section 161 of the WRA. This allows Natural Resources Wales to recover the costs of cleaning up any poisonous, noxious or polluting matter or any solid waste matter that persons have caused or knowingly permitted to be present in controlled waters (i.e. streams, rivers, canals, marine environment and groundwater). The WRA makes it an offence to discharge to controlled waters without the permission or consent of the regulators of those areas. The WRA and WRA 1991 (amendment) (England and Wales) Regulations 2009, Section 93, provides for the establishment of water protection zones.

6.2.11 The Agricultural Land (Removal of Surface Soil) Act 1953[11] makes it an offence to remove surface soils from land in certain circumstances, and for purposes therewith. Removal of surface soil without planning permission is an offence against this Act.

6.2.12 The Agriculture (Wales) Act 2023[12] establishes a new statutory framework for sustainable land management in Wales. It aims to support sustainable agricultural practices and ensure the long-term health and productivity of the land.

National Planning Policy

6.2.13 Planning Policy Wales (PPW) (Edition 12, February 2024)[13] sets out the land use planning policies of the Welsh Government. PPW provides a mechanism for managing contaminated sites through the planning process such that, once

[10] Water Resources Act 1991. Available at: Water Resources Act 1991[Accessed 10/02/2025].
[11] Agricultural Land Act 1953 (1953 Chapter 10 1 and 1 Eliz 2). Available at: Agricultural Land (Removal of Surface Soil) Act 1953 [Accessed:31/01/25]
[12]The Agriculture (Wales) Act 2023 Available at: Agriculture (Wales) Act 2023 [Accessed31/01/25]
[13] Welsh Government (2024):Planning Policy Wales Edition 12 Available at: Planning Policy Wales - Edition 12 [Accessed31/01/25]

developed, the land cannot be determined as “contaminated land” under Part 2A of the Environmental Protection Act 1990 and is suitable for its intended use.

6.2.14 Policies relevant to soils included in PPW can be summarised as follows:

a) **Placemaking in Rural Areas (Paragraph 3.38)** The countryside is a dynamic and multi-purpose resource. In line with sustainable development and the national planning principles and in contributing towards placemaking outcomes, it must be conserved and, where possible, enhanced for the sake of its ecological, geological, physiographic, historical, archaeological, cultural and agricultural value and for its landscape and natural resources. The need to conserve these attributes should be balanced against the economic, social and recreational needs of local communities and visitors. Fostering adaptability and resilience will be a key aim for rural places in the face of the considerable challenge of maintaining the vibrancy of communities and availability of services as well as contributing to the Cohesive Communities well-being goal. This is coupled with ensuring the countryside is resilient to the impacts of climate change and plays a role in reducing the causes of climate change through the protection of carbon sinks and as a sustainable energy source in line with the Resilient Wales well-being goal.

b) **Strategic placemaking (Paragraph 3.47)** More information is given on locational aspects of identifying suitable sites below, including accessibility considerations, the provision of supporting infrastructure, managing urban form and the quality of agricultural land. Such locational choices will also be underpinned by various detailed elements of policy contained throughout this document and will include the making of resilient locational choices which embed considerations of climate change, biodiversity and ecological resilience, sustainable use of resources and protecting the health, amenity and well being of communities.

c) **The Best and Most Versatile Agricultural Land (Paragraph 3.58)** - Agricultural land of grades 1, 2 and 3a of the Agricultural Land Classification system (ALC)16 is the best and most versatile, and should be conserved as a finite resource for the future. **(Paragraph 3.59)** When considering the search sequence and in development plan policies and development management decisions considerable weight should be given to protecting such land from development, because of its special importance.

Local Planning Policy

Flintshire Local Development Plan, 2023

6.2.15 The Scheme lies within the administrative area of Flintshire Council. Flintshire County Council (FCC) adopted their Local Development Plan (LDP) on the 24th

January 2023 and it covers the period 2015 – 2030[14]. It forms part of the statutory development plan alongside The National Plan.

6.2.16 Policies relevant to effects of the Scheme on geology and soils (including contaminated land) include:

a) **Policy EN16 Development on or near Landfill Sites or Derelict and Contaminated Land -** Development proposals on or adjacent to either active or former landfill sites or derelict and contaminated land will be permitted if:

   i) an appropriate investigation has been undertaken to determine the actual or potential presence of landfill gases, leachates and/or other pollutants on the land to be developed;

   ii) appropriate measures are taken to deal with any contamination which exists on the site prior to the development commencing;

   iii) the development of the site is for a vulnerable use, including residential use, then it must be demonstrated that the site is inert, safe and no longer gassing and ensuring that no residual risk remains on site for future receptors;

   iv) the off-site disposal of contaminated waste material is minimised as far as possible; and

   v) measures can be taken to identify and safeguard any significant nature conservation and historic interest which exist on the site.

b) **Policy EN17 Unstable land** - The development of land subject to instability will only be permitted where it can be demonstrated that appropriate measures have been or will be taken to ensure long term safety. New development which would create a risk of land instability will only be permitted if:

   vi) steps are taken to negate the risk of instability; and

   vii) it would not put adjacent land users and the general public at risk.

[14] Flintshire County Council, Flintshire Local Development Plan, Available at https://www.flintshire.gov.uk/en/Resident/Planning/Local-Development-Plan.aspx [Accessed:31/01/25]

Waste Topic Paper No5 & No6, 2015 Summary[15]

6.2.17 Flintshire has a large number of closed landfill sites. Development on such sites can bring with it associated risks due to the release of gas, leachate and issues relating to stability.

6.2.18 The Plan will ensure that risks posed by active or former landfill sites are minimised by directing sensitive development away from inappropriate sites. Issues to be addressed by the Plan which may be relevant to the Scheme include:

a) balance the need to safeguard minerals of economic importance with the need for growth;

b) ensure legacies left by mining and issues of land instability are addressed where necessary;

c) protect areas of importance to the natural environment and built heritage from inappropriate mineral development;

d) encourage the sustainable use of minerals and the use of recycled materials; and

e) ensure risks posed by active or former landfill sites are minimised by directing sensitive development away from inappropriate sites.

6.2.19 The local policy does not include reference to the protection of best and most versatile agricultural land instead it refers to national policy paragraphs 3.58 and 3.59 of PPW[13].

Relevant guidance

6.2.20 The overarching framework for the assessment of potential land contamination is presented in LCRM[2]. This provides a step by step methodology for investigating land contamination, assessing risks posed and determining any remediation requirements.

6.2.21 The framework for soil assessment is based on the guidelines provided by the Ministry of Agriculture, Fisheries and Food (1988) in the document titled

[15] Flintshire Local Development Plan (February 2015) Waste Topic Paper No 5 – Summary - http://www.flintshire.gov.uk/en/PDFFiles/Planning/Topic-papers/Waste.pdf [Accessed 10/02/2025

"Agricultural Land Classification of England and Wales: Revised Guidelines and Criteria for Grading the Quality of Agricultural Land."[16]

6.3 Assessment Methodology

6.3.1 The assessment has been undertaken in accordance with DMRB LA 109 Geology and Soils[1]. The environmental assessment covers geology, soils, as well as the effects from contamination on human health, surface water and groundwater. The outcome has been used to aid the development of appropriate mitigation measures in order to avoid or reduce potential significant adverse effects.

6.3.2 The assessment has been undertaken in accordance with the principles set out in Chapter 4 of this ES.

Assessment of sensitivity

6.3.3 The sensitivity (value) of receptors has been determined according to descriptions provided within Table 1.1.

[16] Ministry of Agriculture, Fisheries and Food (1988). Agricultural Land Classification of England and Wales: Revised guidelines and criteria for grading the quality of agricultural land

Table 6-1 Scale of the Evaluation of the Sensitivity of Receptors

Receptor value (sensitivity)	Criteria	Description
Very high	International scale: Very high importance and rarity and very limited potential for substitution	**Geology**: Very rare and of international importance with no potential for replacement (e.g. UNESCO World Heritage Sites, UNESCO Global Geoparks, (SSSIs) and Geological Conservation Review (GCR) sites where citations indicate features of international importance). Geology meeting international designation citation criteria which is not designated as such. **Soils**: 1) Soils directly supporting a site within the National Site Network (e.g. Special Area of Conservation (SAC), Special Protected Area (SPA)), or a Ramsar. 2) ALC grade 1 & 2. **Contamination**: 1) Human health: very high sensitivity land use such as residential or allotments. 2) Surface water: Watercourse having a Water Framework Directive (WFD) classification shown in a RBMP and Q95 ≥1.0m3/s. Site protected/designated under legislation (SAC, SPA, SSSI, Ramsar site, salmonid water)/species protected by legislation. 3) Groundwater: Principal aquifer providing a regionally important resource and/or supporting a site protected under legislation. Groundwater locally supports Groundwater Dependent Terrestrial Ecosystems (GWDTE). Source Protection Zone 1 (SPZ1).

Receptor value (sensitivity)	Criteria	Description
High	National scale: High importance and rarity, limited potential for substitution	**Geology**: Rare and of national importance with little potential for replacement (e.g. geological SSSI, Area of Special Scientific Interest (ASSI), National Nature Reserves(NNR)). Geology meeting national designation citation criteria which is not designated as such. **Soils**: 1) Soils directly supporting a UK designated site (e.g.SSSI). 2) ALC grade 3a. **Contamination**: 1) Human health: high sensitivity land use such as public open space. 2) Surface water: Watercourse having a WFD classification shown in a RBMP and Q95 <1.0m3/s. Species protected under legislation. 3) Groundwater: Principal aquifer providing locally important resource or supporting a river ecosystem. Groundwater supports a (GWDTE). Source Protection Zone 2 (SPZ2).

Receptor value (sensitivity)	Criteria	Description
Medium	Regional scale: Medium quality and rarity	**Geology**: Of regional importance with limited potential for replacement (e.g. RIGS). Geology meeting regional designation citation criteria which is not designated as such. **Soils**: 1) Soils supporting non-statutory designated sites (e.g. Local Nature Reserves (LNR), Local Geological Sites (LGSs), Sites of Nature Conservation Importance (SNCIs)). 2) ALC grade 3b. **Contamination**: 1) Human health: medium sensitivity land use such as commercial or industrial. 2) Surface water: Watercourses not having a WFD classification shown in a RBMP and Q_{95}>0.001m^3/s. 3) Groundwater: Aquifer providing water for agricultural or industrial use with limited connection to surface water. SPZ3.
Low	District scale: Low quality and rarity	**Geology**: Of local importance/interest with potential for replacement (e.g. non designated geological exposures, former quarries/mining sites). **Soils:** 1) Soils supporting non-designated notable or priority habitats. 2) ALC grade 4 & 5. **Contamination**: 1) Human health: low sensitivity land use such as highways and rail. 2) Surface water: Watercourses not having a WFD classification shown in a RBMP and $Q_{95} \leq 0.001m^3/s$. 3) Groundwater: Unproductive strata.

Receptor value (sensitivity)	Criteria	Description
Negligible	Local scale: Very low importance and rarity	**Geology:** No geological exposures, little or no local interest. **Soils:** Previously developed land formerly in 'hard uses' with little potential to return to agriculture. **Contamination:** 1) Human health: undeveloped surplus land or no sensitive land use proposed. 2) Surface water: use sensitivity criteria in Road drainage and water environment LA 113. 3) Groundwater: use sensitivity criteria in Road drainage and water environment LA 113.

Source: LA109 and LA113

Magnitude of impact

6.4.3 The magnitude of impact includes consideration of its timing, scale, size, and duration. The qualitative magnitude of each impact has been determined according to the descriptions provided in Table 1.2.

Table 6-2 Magnitude of impact and typical descriptions

Magnitude of impact (change)	Description
Major	**Geology**: Loss of geological feature, designation, quality or integrity, severe damage to key characteristics, features or elements. **Soils**: Physical removal or permanent sealing of >20 hectares of agricultural land. **Contamination**: Human health: Significant contamination identified. Contamination levels significantly exceed background levels and relevant screening criteria (e.g. category 4 screening levels) with potential for significant harm to human health. Contamination heavily restricts future use of land.

Magnitude of impact (change)	Description	
	Major Adverse: Surface Water: Failure of acute-soluble and chronic-sediment related pollutants in Highways England Water Risk Assessment Table (HEWRAT) and compliance failure with Ecological Quality Standards (EQS) value. Calculated risk of pollution from a spillage ≥2% annually (spillage assessment). Loss or extensive change to a fishery. Loss of regionally important public water supply. Loss or extensive change to a designated nature conservation site. Reduction in water body WFD classification. Groundwater: Loss of, or extensive change to, an aquifer. Loss of regionally important water supply. Potential high risk of pollution to groundwater from routine runoff – risk score >250 (Groundwater quality and runoff assessment). Calculated risk of pollution from spillages >2% annually (spillage assessment). Loss of, or extensive change to GWDTE or baseflow contribution to protected surface water bodies. Reduction in water body WFD classification. Loss of significant damage to major structures through subsidence or similar effects.	Major Beneficial: Surface Water: Removal of existing polluting discharge or removing the likelihood of polluting discharges occurring to a watercourse. Improvement in water body WFD classification. Groundwater: Removal of existing polluting discharge to an aquifer or removing the likelihood of polluting discharges occurring. Recharge of an aquifer. Improvement in water body WFD classification.

Magnitude of impact (change)	Description
Moderate	**Geology:** Partial loss of geological feature or designation, potentially adversely affecting the integrity; partial loss of or damage to key characteristics, features or elements. **Soils**: Physical removal or permanent sealing of 1 – 20 hectares of agricultural land; or Permanent loss or reduction of one or more soil function(s) and restriction to current or approved future use (e.g. through degradation, compaction, erosion of soil resource). **Contamination:** Human heath: contaminant concentrations exceed background levels and are in line with limits of relevant screening criteria (e.g. category 4 screening levels). Significant contamination can be present. Control or remediation measures are required to reduce risks to human health and make land suitable for intended use.

Magnitude of impact (change)	Description	
	Moderate Adverse: Surface water: Failure of both acute-soluble and chronic-sediment related pollutants in HEWRAT but compliance with EQS values. Calculated risk of pollution from spillages ≥1% annually and <2% annually. Partial loss in productivity of a fishery. Degradation of regionally important public water supply or loss of major commercial/industrial/agricultural supplies. Contribution to reduction in water body WFD classification. Groundwater: Partial loss or change to an aquifer. Degradation of regionally important public water supply or loss of significant commercial/industrial/agricultural supplies. Potential medium risk of pollution of groundwater from routine runoff – risk score 150 – 250. Calculated risk of pollution from spillages ≥1% annually and <2% annually. Partial loss of the integrity of GWDTE. Contribution to reduction in water body WFD classification. Damage to major structures through subsidence or similar effects or loss of minor structures.	Moderate Beneficial: Surface water: HEWRAT assessment of both acute-soluble and chronic-sediment related pollutants becomes pass from an existing site where the baseline was a fail condition. Calculated reduction in existing spillage by 50% or more (when existing spillage risk >1% annually). Contribution to improvement in water body WFD classification. Groundwater: Calculated reduction in existing spillage risk by 50% or more (when existing spillage risk is >1% annually). Contribution to improvement in water body WFD classification. Improvement in water body catchment abstraction management Strategy (CAMS) (or equivalent) classification. Support to significant improvements in damaged GWDTE

<table>
<tr><th>Magnitude of impact (change)</th><th colspan="2">Description</th></tr>
<tr><td rowspan="2">Minor</td><td colspan="2">Geology:
Minor measurable change in geological feature or designation attributes, quality or vulnerability; minor loss of, or alteration to, one (maybe more) key characteristics, features or elements.
Soils:
Temporary loss or reduction of one or more soil function(s) and restriction to current or approved future use (e.g. through degradation, compaction, erosion of soil resource.
Contamination:
Contaminant concentrations are below relevant screening criteria (e.g. category 4 screening levels). Significant contamination is unlikely with a low risk to human health. Best practice measures required to minimise risks to human health.</td></tr>
<tr><td>Minor Adverse:
Surface water: Failure of either acute-soluble or chronic-sediment related pollutants in HEWRAT. Calculated risk of pollution from spillages ≥0.5% annually and <1% annually. Minor effects on water supplies.
Groundwater: Potential low risk of pollution to groundwater from routine runoff – risk score <150. Calculated risk of pollution from spillages ≥0.5% annually and <1% annually. Minor effects on aquifer, GWDTEs, abstraction, and structures.</td><td>Minor Beneficial:
Surface water: HEWRAT assessment of either acute-soluble or chronic-sediment related pollutants becomes pass from an existing site where the baseline was a fail condition. Calculated reduction in existing spillage risk by 50% or more (when existing spillage risk is <1% annually).
Groundwater: Calculated reduction in existing spillage risk by 50% or more to an aquifer (when existing spillage risk</td></tr>
</table>

Magnitude of impact (change)	Description
Negligible	**Geology:** Very minor loss or detrimental alteration to one or more characteristics, features or elements of geological feature or designation. Overall integrity of resource not affected. **Soils**: No discernible loss or reduction (<1 hectare) of soil function(s) that restrict current or approved future use. **Contamination**: Human health: contaminant concentrations substantially below levels outlined in relevant screening criteria (e.g. Category 4 Screening Levels). No requirement for control measures to reduce risks to human health or to make land suitable for intended use. Surface water: No risk identified by HEWRAT (pass both acute-soluble and chronic-sediment related pollutants). Risk of pollution from spillages
No change	**Geology:** No temporary or permanent loss/disturbance of characteristics features or elements. **Soils:** No loss/reduction of soil function(s) that restrict current or approved future use. **Contamination:** Human health: reported contaminant concentrations below background levels. Surface water: No loss or alteration of characteristics, features, or elements; no observable impact in either direction. Groundwater: No loss or alteration of characteristics, features, or elements; no observable impact in either direction.

Source: Adapted from Table 3.12 of LA109 Geology and Soils and Road Drainage and Water Environment LA113

Assessment of significance of effect

6.4.4 In accordance with DMRB LA 109 Geology and Soils Section 3.14, deriving the significance of effect from the receptor value and the magnitude of impact has been undertaken in accordance with DMRB LA 104 'Environmental Assessment and Monitoring'. Subsequent to identifying an appropriate receptor sensitivity and magnitude of impact using Table 1.1 and Table 1.2, the likely significance category and overall significance of effects is identified, as shown in Table 1.3. The approach to assigning significance of effect relies on reasoned

argument, the professional judgement of competent experts and using effective consultation to ensure the advice and views of relevant stakeholders are taken into account. Effects of moderate significance and above (adverse and beneficial) are considered 'significant'.

Table 6-3 Criteria for assessing significance of effect

		Magnitude of impact (degree of change)				
		No change	Negligible	Minor	Moderate	Major
Environmental value (sensitivity)	Very high	Neutral	Slight	Moderate or Large	Large or Very Large	Very Large
	High	Neutral	Slight	Slight or Moderate	Moderate or Large	Large or Very Large
	Medium	Neutral	Neutral or Slight	Slight	Moderate	Moderate or Large
	Low	Neutral	Neutral or Slight	Neutral or Slight	Slight	Slight or Moderate
	Negligible	Neutral	Neutral	Neutral or Slight	Neutral or Slight	Slight

Source: Adapted from DMRB LA 104 - Section Environmental assessment and monitoring Revision 1: Table 3.8.1

6.4 Baseline Conditions

Study area

6.4.1 DMRB LA 109 states that the study area shall be defined on a project-by-project basis defined through professional judgement, based on the type and scale of the Scheme and the context of the surrounding area. The study area for the assessment of geology and soils encompasses the area over which the Scheme could be reasonably expected to have an effect. With respect to geology and soils, this generally only relates to the areas anticipated to be directly disturbed by the proposed physical works and ground disturbance. The study area for the assessment of geology and soils is therefore the Red Line Boundary.

6.4.2 The study area for contamination comprises the scheme boundary and an additional buffer of 500m. This area is considered appropriate for the consideration of historical and current potentially contaminative land uses and pollution incidents. It also considers potential contamination sources outside the scheme area which have the potential to migrate to the Scheme area (areas of landfill or historical potentially contaminative land use, for example) and any sensitive receptors which may feasibly be affected by the uncontrolled migration of contaminants outside the Scheme area.

Geological setting

6.4.3 A number of BGS published maps, geological memoirs and technical documents have been referenced within the Preliminary Sources Study Report (PSSR)[17] to assess the geology of the Scheme.

6.4.4 An extract of the bedrock and superficial geological maps from the BGS of the area are shown in Figure 6-1 and Figure 6-2.

Superficial deposits

6.4.5 The superficial deposits comprise:

a) Tidal Flat Deposits: Present across the entire Scheme, following the historical route of the River Dee. Described as organic-rich clay, silt, sand and gravel. Reported up to a maximum thickness of 16.3m, with deposits beneath the Scheme approximately 15m thick, thinning westward towards the railway bridge where deposits are approximately 9m thick.

b) Glacial Till: Present at the surface south-west of the Scheme, expected to underlie the Tidal Flat Deposits. Described as a variable lithology, usually a sandy, silty clay with pebbles. Proven to a depth of at least 27m, the base was not proven during the ground investigation.

6.4.6 The available information indicates that the Scheme is generally underlain by Tidal Flat Deposits at the surface, with Glacial Till only present at the surface in the south-west. Where Glacial Till is not present at the surface it is expected to be present beneath the Tidal Flat Deposits over the entire Scheme extents.

[17] Mott MacDonald. 2018. A494 River Dee Bridge Improvement – Preliminary Sources Study Report, ref. 395318-0044-B, dated 06/09/2018.

Solid geology

6.4.7 The bedrock geology consists of the Etruria Formation, Middle Coal Measures and Lower Coal Measures. The bedrock has been disrupted by faulting that is pervasive across the region.

6.4.8 In more detail, the bedrock geology comprises (in order of youngest to oldest):

a) Etruria Formation (formerly: Ruabon Marl Formation): Located to the east of the Scheme. A mottled mudstone with lenticular sandstones and conglomerates.

b) Pennine Coal Measures:

i) Middle Coal Measures: Present to the north of the River Dee Bridge and east / south-east of the study area. Lies beneath the younger Etruria Formation. An interbedded grey mudstone, siltstone and sandstone with commonly occurring coal seams.

ii) Lower Coal Measures: Present across the entire Scheme area south of the River Dee Bridge, beneath the Middle Coal Measures. An interbedded grey mudstone, siltstone and sandstone, commonly with mudstones containing marine fossils in the lower part; more numerous and thicker coal seams in the upper part.

6.4.9 Ground conditions reported in the PSSR[17] did not prove the base of the superficial deposits beneath the Scheme. Glacial Till was proven to at least 27m below ground level (bgl) in one borehole during a previous ground investigation[18].

Structural geology

6.4.10 The Etruria Formation lies unconformably over the Middle Coal Measures. To the east of the study area the Etruria Formation has been downthrown against the Middle Coal Measures. At the River Dee Bridge there is a fault that runs approximately south-east to north-west where the Middle Coal Measures to the north have been downthrown against the Lower Coal Measures.

Mining and quarrying

[18] Faber Maunsell. AECOM, A494 Drome Corner to Ewloe Improvements Geotechnical Report, Report Number 36057M/0015, April 2008

The PSSR[17] identified that the Scheme lies in a primary opencast coal resource area due to the presence of shallow coal seams beneath the site. It is also shown that, coincident with the shallow coal, fireclay and brick clay are also present which may have been extracted. Several coal seams and mining locations are present along the A494 south of the Queensferry Interchange. A Coal Authority (renamed to Mining Remediation Authority) report[19] included in the geotechnical report undertaken in 2008 indicates that no coal seams or mining locations are located within the study area. There are no records of any claims for subsidence or known shallow mine workings. The superficial deposits beneath the Scheme are proven to a thickness of at least 27m and so it is not anticipated that shallow mining will have taken place. A plan of the potential historical mining and stability issues within 500m of the Scheme are shown in Figure 6-7.

The Interactive Mining Remediation Authority Map[20] of the area confirmed the presence of a surface coal resource area covering the extent of the Scheme. The map also identified the location of high-risk development areas and former shallow workings south of Queensferry.

Topography

6.4.11 The banks of the River Dee sit at approximately 5m above ordnance datum (AOD). The river was realigned in 1737 to form a straight channel from Chester to the river mouth. The original course of the river ran to the north of its current position from Chester through Sealand and Burton. To the north-east of the river the land continues to lie flat at 5mAOD. To the southwest of the river, the elevation gradually rises to 10mAOD at Queensferry Interchange. Past this point the elevation increases more steeply towards the south-west.

Hydrology

[19] The Coal Authority. 2005. Coal Mining Report – Land at A494 Connah's Quay, dated 19th July 2005, ref. 00019583-05.
[20] The Coal Authority. 2018. The Coal Authority – Interactive Map. Available at: Mining Remediation Authority Map Viewer [Accessed 10/02/2025]

6.4.12 The River Dee is a major watercourse running through the Scheme at its eastern end. The river is tidal in the vicinity of the Scheme. The bed of the river rises from the mouth of the estuary, in the north-west, to Chester in the south-east.

Hydrogeology

An extract of the aquifer designation maps of the area are shown in Figure 6-3 and Figure 6-4.

6.4.13 The Pennine Coal Measures are described as a Secondary A Aquifer which suggests that there could be some movement of groundwater through the permeable sandstone layers, whilst the permeability will be reduced through the predominant mudstone layers. The extensive faulting in the area is likely to provide groundwater pathways.

6.4.14 The superficial Tidal Flat Deposits are described as a Secondary (Undifferentiated) Aquifer, vertical movement of groundwater would likely be impeded by the impermeable clay layers that are interbedded with the granular material. There would likely be stronger horizontal flow paths through the granular layers. The Glacial Till is described as unproductive strata.

6.4.15 Secondary aquifers are capable of supporting water supplies at a local rather than strategic scale and, in some cases, form an important source of base flow to rivers.

Geologically sensitive sites

6.4.16 Data Map Wales[21] provided by the Welsh Government does not identify any geological conservation sites within the vicinity of the Scheme study area. The superficial deposits are up to 27m thick and therefore, no important geological exposures are anticipated to be present.

Potential contamination risks

[21] Welsh Government, Data Map Wales, Available at New map | DataMapWales (gov.wales), [Accessed 12/02/2025]

6.4.17 The PSSR[17] discussed the findings of the A494 Drome Corner to Ewloe Improvements Geotechnical Report which included an assessment of background information. Adjacent to the eastern bank of the River Dee is a section where contamination is likely to be present due to historic potentially contaminative activities including coal storage, ship building, a tarmacadam works, sewage works, chemical works and a tank cleaning operation. Extensive ground and groundwater contamination has been reported for the former Neston Tank Cleaning site, immediately south of the River Dee. The contaminated land risk assessment undertaken for the A494 Access Road[22] undertook a review of available data along the proposed access road immediately south of the Scheme within the footprint of the former Queensferry Chemical Works. The report highlights:

a) The intensive industrial heritage of the Neston site, including the Queensferry Chemical Works and subsequent industries, left a significant legacy of contamination across the Site.

b) Remediation was undertaken between 1994 and 1995 comprising bulk removal of contaminated material and placement of a 1050mm stone capping layer.

c) Despite the remediation completed, there is the potential that other, deeper, areas of contamination (contamination of the Marine Deposits down to 10m bgl was discussed in previous reporting) may still be present beneath the 1050mm thick capping layer.

d) Groundwater beneath the Site is reported to be contaminated.

e) The northern section of the NTCS is now in use as a gypsy traveller site with hardstanding and service buildings, the southern two-thirds comprises derelict land and is currently a disused car scrap yard.

6.4.18 The geotechnical report identified isolated shallow soil contamination in two areas along the Scheme area; St. David's Park Interchange and Garners Yard Area. The report concluded that the contamination does not pose a significant risk to human health and is not pervasive across the Scheme.

[22] Mott MacDonald. 2018. A494 River Dee Bridge Chemistry Lane Access Road – Phase 1 Contaminated Land Risk Assessment, ref.395318-0057-A.

6.4.19 No landfills are located within 500m of the Scheme. Two pollution incidents were reported within 1km of the Scheme; these both relate to air pollution incidents with no impact on land or water.

6.4.20 A plan of the potentially contaminative land uses and environmental incidents within 500m of the Scheme is shown in Figure 6-6.

Unexploded ordnance

6.4.21 An unexploded bomb risk map was requested as part of the PSSR[17]. This map shows that the whole of the Scheme area is at a low risk from unexploded bombs. Although this initial search indicated a low risk, given the proximity of the site to potential military and industrial targets a more thorough UXO assessment was carried out which confirmed that the Scheme is within a low-risk area.

Agricultural land classification (ALC)

6.4.22 An overview of ALC grades, including their definitions and relation to BMV land, is included below[23]:

a) Grade 1 – excellent quality agricultural land (BMV);
b) Grade 2 – very good quality agricultural land (BMV);
c) Grade 3 – good to moderate quality agricultural which is further subdivided into subgrade 3a good quality agricultural land BMV and subgrade 3b moderate quality agricultural land;
d) Grade 4 – poor quality agricultural land;
e) Grade 5 – very poor quality agricultural land; and
f) Non-agricultural land.

6.4.23 Initial desk-top examination of predictive ALC maps for Wales[24], indicate that much of the land within the Scheme area is Urban except for a parcel of land south-east of the A494 between Fox's Drive and the River Dee.

[23] Ministry of Agriculture, Fisheries and Food (1988). Agricultural Land Classification of England and Wales: Revised guidelines and criteria for grading the quality of agricultural land.
[24] Welsh Government, Data Map Wales, Predictive Agricultural Land Classification (ALC) Map 2, Available at: New map | DataMapWales (gov.wales) [Accessed 31/01/2025]

6.4.24 An extract of the predictive ALC maps of the area are shown in Figure 6-5.

6.4.25 One post-1988 ALC survey[25] was undertaken east of the Scheme between the A494 and Manor Road (Ferry Bank Farm, Sealand (1995) 054-95). Within the extents of the surveyed area it was confirmed that the majority of the land is Grade 2 (best and most versatile land), with smaller pockets of Non-Agricultural in areas of drains.

6.4.26 An Agricultural Land Classification survey for the area proposed for the construction Site Compound south-east of the A494 was undertaken by Mott MacDonald in 2019. The survey area comprises a 2.8- hectare area of arable land situated between Queensferry and Garden City, directly north of the River Dee (easting 332682, northing 368560). The report classified the satellite compound area as comprising exclusively Grade 1 (‘Excellent’) soil resources.

6.4.27 The Agricultural Land Classification & Soil Management Plan report forms Appendix 6.A.

Soil Associations

6.4.28 National Soil Map[26] suggests that the Scheme soils at the area proposed for the construction Site Compound south-east of the A494 comprise the Wisbech Association. The Association consists mainly of coarse silty calcareous alluvial gley soils over stoneless marine alluvium. Mottling of subsoils can be extensive, reflecting that the soils are waterlogged for long periods during winter (Wetness Class IV). Given the riverside location, the identification of this soil type in mapping corroborates the preconception that the soils would consist of silty soils created from past salt marshes associated with the canalisation of the river during the early 18th century.

[25] Welsh Government, Data Map Wales – Post 1988 Agricultural Land Classification (Wales) Surveys - Boundary, Available at New map | DataMapWales (gov.wales), [Accessed 31/01/2025]
[26] Soil Survey of England and Wales (1984). Soils and their Use in Southwest England – Bulletin 14.

Baseline receptor summary

6.4.29 From the baseline data above, the receptors that have the potential to be affected by the Scheme are summarised within Table 1.4.

Table 6-4 Baseline receptor summary

Receptor		Receptor sensitivity	Reasoning
Geology		Negligible	No Regionally Important Geological / Geomorphological Sites are reported within the vicinity of the Scheme.
Contamination	Human Health – Site end users	Low - Medium	The Scheme's footprint includes medium sensitivity land use such as commercial or industrial and low sensitivity land use such as roads.
	Controlled Waters – Groundwater	Medium	The Scheme is underlain by the Pennine Coal Measures (Secondary A Aquifer) and by Tidal Flat Deposits (Secondary Undifferentiated Aquifer) capable of supporting water supplies at a local rather than strategic scale.

Receptor		Receptor sensitivity	Reasoning
	Controlled waters – Surface Water	Very High	The River Dee is designated as a Site of Special Scientific Interest (SSSI) for its fluvial geomorphology, carboniferous geology, range of river habitat types and fish species and Special Protection Area (SAC) Designated for its coastal habitats and fish species.
Soils	ALC Grade 1	Very High	Grade 1 agricultural soils identified south-east of the A494 in the location of the proposed satellite compound.
	ALC Grade 2	High	Grade 2 agricultural soils are predicted to be present between the River Dee and Fox's Drive on the eastern bank of the river with the boundary of the satellite compound.
	Urban Land	Negligible	The Scheme would mostly cross soils designated as Urban Land.

Source: Adapted from DMRB LA 109 and LA113 - Section Environmental assessment and monitoring Revision 1: Table 3.8.1

6.5 Mitigation Measures Forming Part of the Scheme Design

Embedded mitigation

6.5.1 The Scheme has been designed, as far as reasonably practicable, to minimise effects on geology and soils. The design development process has sought to

avoid and reduce environmental effects on agricultural land by minimisation of the design footprint and restoring the Site Compound area to agricultural land after construction.

6.5.2 The Scheme proposes to restore the stretches of existing highway that will be replaced with grassland, shrub and tree planting requiring the importation of suitable soil forming materials.

Essential mitigation

6.5.3 Appropriate mitigation options have been identified based on a review of guidance provided in the English Nature Publication[27], and by using professional judgement.

6.5.4 The following general measures should be adopted during the construction stage to minimise environmental impacts.

Construction Environmental Management Plan

6.5.5 An Outline Construction Environmental Management Plan (Outline-CEMP) would be produced to support the application and would be developed into a full Construction Environmental Management Plan (CEMP) by the appointed Contractor.

Protection of Soil Structure and Quality

6.5.6 The inclusion of a Soils Management Plan (SMP) within the CEMP would ensure works are undertaken in accordance with appropriate guidelines such as Defra's Code of Practice for the Sustainable Use of Soils on Construction Sites[28] and BS3882:2015[29], particularly in areas where the reinstatement of agricultural land would be required after construction.

6.5.7 Mitigation measures, in addition to topsoil and subsoil stripping and storage, include the use of a proprietary geotextile membrane to protect the existing

[27] English Nature (2006), *Geological conservation – a guide to good practice* [online] available at: http://publications.naturalengland.org.uk/publication/83048 [Accessed 12/02/2025].
[28] Department for Environment, Food and Rural Affairs, Construction Code of Practice for the Sustainable Use of Soils on Construction Sites, 2009 Available: Construction Code of Practice for the Sustainable Use of Soils on Construction Sites Accessed [31/01/2025].
[29] British Standard for Topsoil, BS3882:2015 – Specification for Topsoil and requirements for use

ground condition where site compounds and storage areas are located. A layer of inert crushed granular material placed on a geotextile membrane would form temporary running surfaces.

6.5.8 Where importation of topsoil is required for spreading on areas of newly constructed earthworks, this would be selected in accordance with BS3882:2015 to ensure that the topsoil provides suitable substrates for native plant species and to maximise biodiversity, in accordance with industry best practice.

Protection of Controlled Waters: General

6.5.9 Since the Scheme would be located across Secondary Aquifers in the superficial deposits and bedrock geology, there is a risk that the works would create pollution pathways to groundwater resources. To prevent contamination of the aquifer, the Contractor would take precautions, in line with all associated pollution prevention guidelines and best practice, to ensure that pollution of the aquifer cannot occur and new pathways for contaminant migration are not established when working in areas where Made Ground or contaminated materials are present.

6.5.10 Excavated materials would be managed in line with the requirements in the Outline-CEMP and eventual CEMP, including (but not limited to) the following measures:

a) stockpiles would be located away from principal surface watercourses. The careful management of construction site drainage would be undertaken, including the use of cut-off ditches to collect site run-off, with run-off passed through settling lagoons or silt traps to allow removal of sediments prior to discharge. Where considered necessary, treatment plant would be made available on-site, including:

   i) settlement tanks;

   ii) chemical dosing plant (addition of coagulants / flocculants to ensure slow settling solids can be removed);

   iii) concrete washwater treatment plant (designed to deal with high pH washwater from concrete construction works);

   iv) oil-water separators; and

   v) materials separators (to separate and recover sand and gravel).

b) management of excavated topsoil and subsoils would be in line with the guidance provided within the SMP. There would be clear segregation of materials with dust suppression measures and covers for stockpiles as necessary. Where stockpiles are long term, seeding would be considered to minimise soil being entrained in run-off water and being transported to drainage ditches;

c) works would be monitored by a suitably qualified Site Environmental Clerk of Works, to be responsible for identifying and approving all methods of pollution control; and

d) an auditing programme would be implemented to verify environmental performance.

Protection of Controlled Waters: Foundation Works

6.5.11 Since construction would be undertaken over Secondary Aquifers, there is a risk that excavation and foundation works could create vertical pollution pathways.

a) Where piling or penetrative ground improvement is required, the works would be carried out in accordance with EA guidance[30,]

b) Where piling or penetrative ground improvement is required in areas of residual contamination, a foundation works risk assessment will be undertaken to determine the likely effects relating to the driving of piles through any contaminated Made Ground or landfilled materials and into the underlying Secondary Aquifers and to identify what mitigation measures are appropriate for the site. These would include:

i. selection of pile design to minimise pathway creation at soil-pile interface and appropriate choice of piling method;

ii. selection of a suitable class of concrete by qualified geotechnical engineer; and

iii. use of temporary casing to protect groundwater from contact with grout and fines generated during boring.

6.5.12 The pouring of concrete or use of chemicals could result in the contamination of site soils and associated pollution entering the underlying Secondary Aquifers, surface water drains or the River Dee. Therefore, appropriate measures would be included within the Contractor's method statement for the protection of the environment reflecting guidance in the CEMP, including the batching of concrete only in designated impermeable areas with a segregated drainage system,

[30] CL:AIRE (2025) *Piling and penetrative ground improvement methods on land affected by contamination: guidance on pollution prevention.*

placement of temporary bunds down-slope to contain any spillages and the development of a spill response protocol.

6.5.13 The discharge of potentially contaminated groundwater would be appropriately managed by the Contractor through the use of appropriate treatment prior to discharge as discussed in paragraph 6.5.10.

Management of Construction Plant and Materials

6.5.14 Working method statements would be in place during construction reflecting the guidance within the CEMP to ensure environmentally safe working practices on-site with respect to the underlying ground and groundwater. These would include (but not be limited to):

a) the storage of oil, fuel and other potentially hazardous substances would be located within a secure site compound located on a hardstanding area. Storage of these substances would be within an appropriately bunded area (110% of total capacity volume);

b) there would be a designated refuelling and maintenance area and concrete batching area located on impermeable hardstanding with drainage treated appropriately;

c) regular inspections of site plant would be carried out and the use of drip trays and training in the location and use of spill kits and emergency spillage procedures would be provided for site workers. Action Plans would be in place to effectively deal with any contamination issues during construction, for example spillages and leaks from construction plant; and

d) wheel washing facilities with a washwater treatment system in place would be utilised to prevent the transfer of site soils to adjacent roads and best practice dust suppression methods would be employed on-site to prevent soil erosion.

6.5.15 Adjacent areas outside the development boundary would be protected by site fencing to prevent accidental encroachment and damage of topsoil.

Excavations and Dewatering

6.5.16 Excavations below ground level may require dewatering of run-off waters, perched waters or groundwaters from the underlying Secondary Aquifers. This water would be managed on-site through the use of appropriate treatment prior to discharge as discussed in paragraph 6.5.10.

6.5.17 Discharge to surface waters may require an environmental permit and also a land drainage consent if the discharge requires the construction of a new culvert in an ordinary watercourse.

6.5.18 If contamination is present or suspected, on-site treatment or off-site disposal may be required and would be detailed within a Remediation Strategy.

Management of Contamination Risks

6.5.19 The ground investigations undertaken have confirmed the Neston site as containing residual concentrations of contaminants at depth. Construction of the new road on embankment across this area is not expected to present a significant impact; the contamination is present at depth and will not be disturbed.

6.5.20 Where excavations are required, arisings will be managed as waste. The Contractor will develop a method statement which would include specific instructions in relation to:

a) the control of excavation, separation, handling and storage activities to ensure that those soils identified as contaminated are not combined with uncontaminated soil;

b) the on-site treatment of contaminated material, if appropriate, to allow re-use as appropriate thereby minimising the amount for off-site disposal; and

c) the issue of appropriate health and safety procedures when working with contaminated materials.

6.5.21 Risks to construction and maintenance workers would be mitigated through risk assessments undertaken by the Contractor, specific to the works, in order to identify risks and appropriate mitigation measures in line with all relevant health and safety legislation and guidance.

6.5.22 In addition, it is the responsibility of the producer to implement the following measures to mitigate risks associated with potentially contaminated materials:

a) ensure that all material created on-site undergoes basic characterisation prior to reuse / disposal. To ensure on-site waste management is in line with best practice and the waste hierarchy, the following would be implemented:

i) full characterisation of soil and macadam samples in accordance with Guidance on the Classification and Assessment of Waste[31] and determine whether re-use of the soils within the Scheme earthworks could be safely achieved; and

ii) once waste characterisation has been undertaken, the completion of Waste Acceptance Criteria (WAC) testing, where necessary, to establish the acceptability of hazardous, hazardous non-reactive and inert wastes for landfill disposal. Every effort would be made to minimise waste to be landfilled with treatment at an appropriate facility or on-site treatment hub considered in the first instance.

6.5.23 Hazardous substances such as excavated contaminated land, fuels, chemicals, waste and construction materials would be stored, handled, transported and disposed of in accordance with the CEMP and SWMP.

6.5.24 Similar methodologies would also be employed during the selection of any fill for import. Greater detail in respect of proposed screening and testing of imported materials is provided in Chapter 14 Materials.

Works in Areas of Historic Landfills, Infilled Quarries or Made Ground

6.5.25 It is anticipated that works would be undertaken crossing areas of Made Ground, commercial and agricultural land and in the proximity of off-site industrial / commercial land uses. A road construction project would not be considered sensitive to residual contamination present within any areas of Made Ground.

6.6 Assessment of Land Take Effects

6.6.1 As part of the land take, the Scheme would occupy land in the vicinity of the former chemical works / Neston Tank Cleaning site west of the River Dee which is reported to be contaminated. Remediation was undertaken at the former chemical works in 1994[32] comprising removal of some material and placement of a cap over the entire area.

[31] NRW (2021) Guidance on the classification and assessment of waste (Ver 1.2)
[32] WSP. 1995. Former Neston Tank Cleaners Site, Reclamation Works Final Completion Report, August 1995.

6.6.2 During construction temporary agricultural land take of approximately 3.3 hectares of arable land is required for the Site Compound situated between Queensferry and Garden City, directly north of the River Dee.

6.7 Effects Resulting from Changes in Geology and soils

Geology

6.7.1 The effects on geology during construction activities are considered to be negligible. No Regionally Important Geological / Geomorphological Sites or important outcrops are present within the vicinity of the Scheme.

Contamination

6.7.2 Contaminant mobilisation during Scheme construction activities could potentially cause contamination of soils, groundwater and surface water. This will be particularly prevalent in the vicinity of any Made Ground, the former chemical works and other potential contamination sources. The contamination of soils, groundwater and surface water could also occur through accidental spills and leaks relating to construction plant and fuels / oils.

6.7.3 The removal or remediation of any areas of excavated contaminated soils identified would have a beneficial effect.

6.7.4 The effects on contaminated land (human health and controlled waters) during the construction stage are assessed as medium.

Soils

6.7.5 Site construction will lead to the temporary removal of topsoil and some subsoil from agricultural land. The land temporarily required for the Site Compound comprises 3.3. hectares of Grade 1 (‘Excellent’) land according to the 2019 ALC survey.

6.7.6 Soil deterioration and consolidation may occur due to vehicle movements and loading, leading to adverse effects. ALC Grade 1 and predicted Grade 2 soils are present adjacent to the Scheme east of the River Dee in an area proposed for use as a Site Compound.

6.7.7 In the absence of correct soil handling procedures, soil resources are likely to be unnecessarily damaged during construction. Stripping, stockpiling and reinstatement of soils can result in deterioration to soil structure when carried out during inappropriate weather conditions, when the soils have too higher moisture content and when inappropriate machinery is used. Such impacts could result in changes to soil properties and a fundamental loss of key soil functions.

6.8 Assessment of Construction Effects

6.8.1 This section assesses construction stage effects that are applicable to the Scheme. The Scheme includes a range of construction activities which have the potential to result in adverse or beneficial effects on geology and soils.

6.8.2 Principal construction activities of relevance to geology and soils are anticipated to include:

a) excavation works – resulting in the permanent removal of shallow deposits (soils, Made Ground and superficial deposits) and the potential to disturb contaminated materials;

b) earthworks – resulting in waste generation and the disturbance of groundwaters, the generation of excavations which will require dewatering and ground gas risks;

c) general construction works – the storage of hazardous chemicals leading to secondary effects on soils and groundwater; and

d) foundation works – piling or penetrative ground improvement as part of foundation construction may pose risks to controlled waters along with environmental risks relating to the use of concrete in construction.

6.8.3 Table 1.5 summarises the assessment of construction effects, showing the potential effect identified and appropriate mitigation measures for the specified receptor. The Table also includes the receptor sensitivity, magnitude of impact and the significance rating of effects after mitigation has been applied.

Table 6-5 Assessment of likely significant construction effects

Receptor	Sensitivity / Value	Summary of Effect	Magnitude	Mitigation	Significance of Effect
Geology	Negligible	No Regionally Important Geological / Geomorphological Sites or rock exposures are present within the vicinity of the Scheme.	No Change	N/A	Neutral
Contamination: Human Health	Low - Medium	Contaminant mobilisation during construction could cause contamination of soils, groundwater and surface water, particularly in the vicinity of any Made Ground, tank washing facilities, former chemical works and other potential contamination sources. The contamination of soils, groundwater and surface water could also occur through accidental spills and leaks	Minor Adverse (Significant contamination is unlikely with a low risk to human health).	Environmental Management Plan Dust Suppression Protection of Controlled Waters: General Management of Construction Plant and Materials Excavations and Dewatering Management of Contamination Risks	Neutral/ Slight Adverse

Receptor	Sensitivity / Value	Summary of Effect	Magnitude	Mitigation	Significance of Effect
		relating to construction plant and fuels / oils		Works in Areas of Historic Landfills, Infilled Quarries or Made Ground	
Contamination Groundwater (Secondary A Aquifer and Secondary Undifferentiated Aquifer)	Medium	Potential for: Creation of contamination pathways or driving down of contaminants during foundation / piling works; and increased turbidity and quality deterioration within the aquifers, which would result in adverse effects.	Minor adverse	Environmental Management Plan Protection of Controlled Waters: General Protection of Controlled Waters: Foundation Works Management of Construction Plant and Materials Excavations and Dewatering	Slight Adverse

Receptor	Sensitivity / Value	Summary of Effect	Magnitude	Mitigation	Significance of Effect
ALC Grade 1 and Grade 2	Very High	Grade 1 agricultural soils identified south-east of the A494 in the location of the proposed satellite compound. Grade 2 agricultural soils are predicted to be present between the River Dee and Fox's Drive on the eastern bank of the river with the boundary of the satellite compound.	Minor Adverse (Temporary loss or reduction of one or more soil functions)	Environmental Management Plan Protection of Soil Structure and Quality Soil Management Plan (SMP)	Slight Adverse*
Urban Land	Negligible	The Scheme would mostly cross soils designated as Urban Land.	Negligible	N/A	Neutral

*This rating of significance has been provisionally downgraded and based on the understanding that the requirements of a SMP will be adhered to and temporary land take will be subject to a detailed aftercare plan with the objective of returning land with the same ALC grade.

6.9 Assessment of Operational Effects

6.9.1 The effects of the operation of the existing A494 will not significantly change following development of the Scheme. Consideration of the operational effects of the Scheme on geology and soils is therefore not required.

6.10 Additional Mitigation and Monitoring

6.10.1 Any monitoring requirements in relation to contaminated land would be included within the Remediation Strategy.

6.10.2 Any monitoring requirements in relation to geological stability and geotechnical issues would be included in the future geotechnical assessment.

6.10.3 Monitoring recommendations and aftercare requirements for soils are included within the Agricultural Land Classification & Soil Management Plan (Appendix 6.A).

6.11 Assessment of Cumulative Effects.

6.11.1 The cumulative effects of the Scheme, in conjunction with other proposed developments, will be assessed and presented in Chapter 17 Cumulative Effects. Major developments considered for the cumulative effects assessment are set out in Table 1-6.

Table 6-6 Development considered for cumulative effects

Project	Type of Development	Main Effect
Northern Gateway	Mixed Use Development	Traffic generation, drainage to the River Dee, pedestrian and cycle trips, loss of open grassland foraging for wildlife.

Inter-relationships

6.11.2 An inter-effect refers to the impact that changes in geology and soil conditions have on other environmental factors. These impacts include:

a) Road drainage and the water environment – Contaminants from the land (if encountered) can leach into the drainage system, leading to the deterioration of surface and groundwater quality;

b) Waste – Contaminated soils (if encountered) have potential to impact waste management;

c) Air quality – soil disturbance results in generation of dust and air quality impacts; and

d) Biodiversity – loss of soil and land results in reduced habitat for below and above ground biota. Soil compaction can lead to poor vegetation growth.

Intra-relationships

6.11.3 Intra-relationships for geology and soils refer to the interactions and impacts that occur within the geological and soil systems, including aspects of contamination. The construction of the Scheme has the following intra-relationships:

a) Contamination transport – the source of contamination, the pathways through which contaminants travel, and the receptors that are affected by these contaminants;

b) Soil erosion – The removal of the topsoil layer due to wind or water, which affects the soil's structure and fertility;

c) Soil compaction –The compression of soil particles, reducing pore space and affecting root growth and water infiltration; and

d) Soil acidification – A decrease in soil pH due to natural processes or human activities, affecting nutrient availability and microbial activity.

6.12 Summary of Residual Effects

6.12.1 This chapter has provided an assessment of the potential effects of the proposed Scheme on geology and soils. The Scheme baseline has been summarised and an assessment of potential effects completed with subsequent mitigation measures identified.

6.12.2 It is considered that the Scheme has the potential to result in construction stage adverse effects upon soils and the associated environment, such as the potential for:

a) soil deterioration and consolidation due to poor storage and handling; and

b) loss of ALC Grade 1 soils on agricultural land east of the River Dee.

c) discharge of contaminated or sediment laden groundwater to watercourses following dewatering of excavations or foundation works;

d) the creation of contamination pathways or driving down of contaminants presenting a risk to groundwater along with the potential for increased turbidity and quality deterioration within the aquifers;

e) encountering contaminated materials within Made Ground, the mobilisation of contaminants, and the generation of contaminant transport pathways from site activities;

f) contamination of soils, groundwater and surface water from accidental spills and leaks relating to construction plant and fuels / oils; and

g) removal / remediation of any areas of contaminated soils identified (beneficial effect).

6.12.3 A number of measures have been highlighted as being suitable for mitigating the effects identified above, which include measures design to:

a) protect soil structure and quality;

b) protect controlled waters from both general site works and foundation works; and

c) manage contamination risks.

6.12.4 Together the CEMP and LCRM process comprise embedded mitigation measures that deal with temporary and permanent contamination effects respectively. Therefore, once these have been applied there will be no significant adverse effects as a result of the proposed development.

Llywodraeth Cymru / Welsh Government

A494 RIVER DEE BRIDGE REPLACEMENT SCHEME

Environmental Statement

Volume 1: Technical Assessment Report

Chapter 7: Road Drainage and Water Environment

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7. Road Drainage and Water Environment

7.1 Introduction

7.1.1 This chapter describes the assessment of the potential effects on the water environment resulting from the construction and operation of the Scheme. The following water environment receptors and resources are considered in the assessment:

a) Surface water – including the localised impacts to the water quality (routine runoff and spillage) and hydromorphology.

b) Existing water resources receptors (abstractions and discharges on the River Dee).

c) Groundwater – including water quality (routine runoff and spillage) and groundwater levels and flows.

d) Flood risk – including to people, property and infrastructure that could be at risk of flooding.

e) Water Framework Directive (WFD) – including WFD surface water, transitional and groundwater bodies.

f) Protected areas – including European and nationally designated sites that are hydrologically connected to the Scheme.

7.1.2 Additional information to support this chapter is presented in the following appendices and figures:

a) Volume 2, Figure 7.1: A494 River Dee Bridge Improvement surface water bodies

b) Volume 2, Figure 7.2: A494 River Dee Bridge Improvement WFD water bodies

c) Volume 2, Figure 7.3: A494 River Dee Bridge Improvement flood risk from the sea

d) Volume 2, Figure 7.4: A494 River Dee Bridge Improvement flood risk from rivers

e) Volume 2, Figure 7.5: A494 River Dee Bridge Improvement flood risk from surface water and small watercourses

f) Volume 2, Figure 16.1: Marine environment zones of interest

g) Volume 3, Technical Appendix 7.A: River Dee Surface Water Quality Baseline Report[1]

h) Volume 3, Technical Appendix 7.B: Water Framework Directive (WFD) Assessment[2]

i) Volume 3, Technical Appendix 7.C: Highways England Water Risk Assessment Tool (HEWRAT) Assessment[3]

j) Volume 3, Technical Appendix 7.D: Flood Consequences Assessment (FCA)[4]

k) Volume 3, Technical Appendix 7.E: Hydrodynamic and Sediment modelling[5]

l) Volume 3, Technical Appendix 7.F: River Dee Hydraulic Modelling Report - Proposed Development Assessment[6]

m) Volume 3, Technical Appendix 7.G: Queensferry Drain Hydraulic Modelling Report - Proposed Development Assessment[7]

n) Volume 3, Technical Appendix 17.A: Outline Construction and Environmental Management Plan (CEMP)[8].

7.2 Legislation and Policy Framework

7.2.1 Relevant legislation and national and local planning policy applicable to the environmental assessment of the water environment is set out in Tables 7.1 – Table 7.3.

[1] Mott MacDonald, 2025. Technical Appendix: 7.A: River Dee Surface Water Quality Baseline Report. Document reference: 395318-MMD-00-XX-RP-Z-0021.
[2] Mott MacDonald, 2025. Technical Appendix: 7.B: A494 Water Framework Directive Assessment. Document reference: 395318-MMD-00-XX-RP-Z-0020.
[3] Mott MacDonald, 2025. Technical Appendix: 7.C: HEWRAT Assessment. Document reference: 395318-MMD-00-XX-RP-Z-0022.
[4] Mott MacDonald, 2025. Technical Appendix: 7.D: Flood Consequences Assessment. Document reference: 395318-MMD-00-XX-RP-Z-0019.
[5] Mott MacDonald, 2025. Technical Appendix: 7.E: Hydrodynamic and Sediment Modelling Report. Document reference: 395318-MMD-00-XX-RP-Z-0023.
[6] Mott MacDonald, 2025. Technical Appendix 7.F: River Dee Hydraulic Modelling Report - Proposed Development Assessment. Document reference: '395318-MMD-00-XX-RP-D-0010.
[7] Mott MacDonald, 2025. Technical Appendix 7.G: Queensferry Drain Hydraulic Modelling Report - Proposed Development Assessment. Document reference: '395318-MMD-00-XX-RP-D-0011.
[8] Mott MacDonald, 2025. Technical Appendix: 17.A: Outline Construction Environment Management Plan.

Table 7-1 Relevant legislation and policy

Title	Description
The Environment Act 2021 [9]	The Environment Act requires the setting of long-term targets for the recovery of the natural world in four priority areas: air quality, biodiversity, water and waste. Not all 'Part 5- Water' provisions are applicable in Wales.
Environment (Wales) Act 2016[10]	Legislation to amend the Flood and Water Management Act 2010 to promote sustainable management of natural resources; including provision for the protection of the marine environment including European marine sites, to establish the Flood and Coastal Erosion Committee; and to make minor changes to the law about land drainage and byelaws made by Natural Resources Wales (NRW). This legislation has been considered in the assessment due to the proximity of the Scheme to designated marine protected sites.
Water Act 2003[11]	This legislation amends the Water Resources Act 1991 and the Water Industry Act 1991 to make provision with respect to compensation under Section 61 of the Water Resources Act 1991.
Water Resources Act (England and Wales) 1991[12] (Amended 2009)	This legislation sets out the responsibilities of NRW and the Environment Agency (EA) in relation to water pollution, resource management, flood defence, fisheries, and navigation.
Environmental Permitting (England and Wales) Regulations 2016 (as amended) [13]	These regulations set out the regulatory framework for the control of water discharge activities through environmental permitting, exempt some water discharge activities form environmental permitting and provide for compliance obligations. They apply environmental quality standards to waters and certain pollutants and set out measures to prevent discharges of hazardous substances and limit discharges of non-hazardous pollutants into surface and groundwater. This legislation has been considered for the assessment due to the risk of localised deterioration to the water quality.
Water Environment (Water Framework Directive) (England and Wales) Regulations 2017[14]	These regulations aim to protect inland and coastal waters and prevent deterioration of aquatic ecosystems, including groundwaters. The WFD must not prevent deterioration in status for all water bodies. The original target date for all water bodies to achieve 'good status' was 2015; however, this can be extended to either 2021 or 2027. A WFD assessment[2] has been undertaken to assess the potential impacts of the Scheme. The potential impacts and mitigation on the WFD receptors have been incorporated into the Environmental Impact Assessment (EIA).

[9] Environment Act 2021. Available at: https://www.legislation.gov.uk/ukpga/2021/30/enacted/data.pdf. Accessed February 2025.
[10] Environment (Wales) Act 2016. Available at: Environment (Wales) Act 2016 Accessed February 2025.
[11] Water Act 2003 (https://www.legislation.gov.uk/ukpga/2003/37/data.pdf) Accessed February 2025.
[12] Water Resources Act (England and Wales) 1991 (https://www.legislation.gov.uk/ukpga/1991/57/data.pdf) Accessed February 2025.
[13] The Environmental Permitting Regulations 2016. Available at: https://www.legislation.gov.uk/uksi/2016/1154/made/data.pdf. Accessed February 2025
[14] Water Environment (Water Framework Directive) (England and Wales) Regulations 2017.

Title	Description
The Groundwater (Water Framework Directive) (Wales) Direction 2016[15]	The Directive outlines specific measures in order to prevent and control groundwater pollution including criteria for assessing the chemical status of groundwater; criteria for identifying significant and sustained upward trends in groundwater pollution levels, and for defining starting points for reversing these trends; and preventing and limiting indirect discharges (after percolation through soil or subsoil) of pollutants into groundwater. The Groundwater Daughter Directive (GDD) clarifies certain objectives of the WFD relating to the prevention and control of groundwater pollution and establishes groundwater quality standards. The Scheme involves works which have the potential to impact one WFD groundwater body. A WFD assessment[2] has been undertaken to assess the potential impacts of the Scheme. The impacts and mitigation on the WFD receptors have been incorporated into the EIA.
Land Drainage Act 1991 (as amended)[16]	The Act requires that a watercourse be maintained by its owner in such a condition that the free flow of water is not impeded. The Act provides functions to internal drainage boards and local authorities to manage watercourses and provide consenting powers for proposed works to watercourses associated with development. The Scheme involves works to the watercourses, and to existing flood defences.
Environmental Protection Act 1990[17]	Legislation makes provision for controlling pollution arising from industrial and other processes for waste management. It lays out the duty of care required to ensure that waste is handled by authorised carriers and records maintained. The Scheme includes the decommissioning of the existing A494 bridge and waste must be disposed of responsibly in line with the legislator requirements.
The Water Supply (Water Quality) Regulations 2010[18]	These regulations provide the framework for drinking water quality in Wales in respect of public supplies provided by water companies and licensed water suppliers. The Drinking Water Inspectorate, acting on behalf of the Secretary of State, enforces the legislation.
Water Resources (Abstraction and Impounding) Regulations (2006) SI 2006/641[19]	These Regulations contain provisions relating to the licensing of abstraction and impounding of water in England and Wales in the light of amendments made by the Water Act 2003 to the Water Resources Act 1991. This is applicable should impoundment licence be required for the Scheme.
Flood Risk Regulations 2009[20]	The Flood Risk Regulations 2009 transposes the EC Floods Directive (Directive 2008/60/EC) on the assessment and management of flood risk into domestic law in Wales and implements its provisions. The regulations designate a Local Lead Flood Authority (LLFA) and impose duties on NRW and Lead Local Flood Authorities to prepare a number of documents including: Preliminary Flood Consequences Assessments (FCA); Flood hazard and flood risk maps; and Flood Risk Management Plans. This legislation has been considered in the FCA[4].
Pollution Prevention and Control (England and Wales) Regulations 2000[21]	This legislation sets out a pollution control regime for the purpose of implementing the Integrated Pollution Prevention and Control Directive (Council Directive 96/61/EC) and for regulating other environmentally polluting activities not covered by the Directive. The Regulations control the operation of any installation or mobile plant carrying out any of the activities.

[15] The Groundwater (Water Framework Directive) (Wales) Direction 2014. Available at: Microsoft Word - Groundwater (Water Framework Directive) (Wales) Direction 2016 2016 No14 Final 260416. Accessed February 2025.
[16] Land Drainage Act 1991. Available online at: http://www.legislation.gov.uk/ukpga/1991/59/contents. Accessed March 2025.
[17] Environmental Protection Act 1990. Available at: https://www.legislation.gov.uk/ukpga/1990/43/contents Accessed February 2025.
[18] The Water Supply (Water Quality) Regulations 2010. Available at: https://www.legislation.gov.uk/wsi/2010/994/made/data.pdf. Accessed February 2025.
[19] Water Resources (Abstraction and Impounding) Regulations SI 2006/641. Available at: https://www.legislation.gov.uk/uksi/2006/641/made/data.pdf. Accessed February 2025.
[20] Flood Risk Regulations 2009. Available at: http://www.legislation.gov.uk/uksi/2009/3042/pdfs/uksi_20093042_en.pdf. Accessed February 2025.
[21] The Pollution Prevention and Control (England and Wales) Regulations 2000. Available at: https://www.legislation.gov.uk/uksi/2000/1973/made/data.pdf. Accessed February 2025.

Table 7-2 National planning policy

Title	Description
Future Wales: The National Plan 2040[22]	This Policy provides a framework at a national scale which sets out a spatial plan for the direction for development in Wales until 2040. The Policy includes a strategy for addressing key national priorities through the planning system, including economic, decarbonisation and climate-resilience as well as developing strong ecosystems and improving the health and well-being of our communities. The strategic framework will be built on by Strategic Development Plans at a regional level and Local Development Plans at local authority level.
Wales Spatial Plan (Update 2008)[23]	The Wales Spatial Plan sets out the planning agenda for Wales at the spatial level. The main principle is that development should be sustainable and protect water resources and manage flood risk.
Planning Policy Wales Edition 12 (February 2024)[24] (PPW)	The Planning Policy Wales (PPW) sets out the Welsh Government land use planning policies and is supplemented by a number of Technical Advice Notes (TANs). It outlines design approaches and techniques to improve water efficiency and minimise adverse impacts of developments on water resources, surface water quality, rivers and groundwaters. In addition, consideration to avoidance of unnecessary flood risk for new developments is highlighted.
Technical Advice Note (TAN) 5: Nature Conservation and Planning (2009)[25]	TAN 5 supplements the PPW and gives advice as to the consideration of impacts on designated sites in relation to the water environment.

[22] Welsh Government, 2021. Future Wales: The National Plan 2040. Available at: Update to Future Wales - The National Plan 2040 (gov.wales). Accessed February 2025.
[23] Welsh Assembly Government, 208. People, places, futures. The Wales Spatial Plan 2008 update. Available at: Cover + Pocket 2008.indd Accessed February 2025.
[24] Welsh Government, 2024. Planning Policy Wales Edition 12. Available at: https://www.gov.wales/sites/default/files/publications/2024-07/planning-policy-wales-edition-12.pdf. Accessed February 2025.
[25] Technical Advice Note 5 Nature Conservation and Planning, 2009. Available at: https://www.gov.wales/sites/default/files/publications/2018-09/tan5-nature-conservation.pdf. Accessed February 2025.

Title	Description
Technical Advice Note (TAN) 15: Development and Flood Risk (2025)[26]	TAN 15 supplements the Planning Policy Wales providing technical guidance in relation to development and flood risk and advises on a framework for the assessment of flooding. This has been considered in the FCA[4]. The impacts on receptors have been incorporated into the EIA.

[26] Technical Advice Note (TAN) 15, 2025. Available at: guidance-on-the-town-and-country-planning-flood-risk-area-development-notification-wales-direction-2025-wgc-0022025.pdf. Accessed July 2025.

Table 7-3 Local planning policy

Title	Description
Flintshire Local Development Plan 2015 – 2030 Adopted Plan[27]	Flintshire County Council (FCC) adopted its Local Development Plan (FLDP) 2015-2030 which forms part of the statutory development plan in alignment with Future Wales: The National Plan 2040. The FLDP reference strategic policies relevant to Road Drainage and the Water Environment chapter including: STR4: Principles of Sustainable Development and Design; STR5: Transport and Accessibility; STR6: Services, Facilities and Infrastructure; STR13: Natural and Built Environment, Green Networks and Infrastructure and STR14: Climate Change and Environmental Protection.
Flintshire Local Flood Risk Management Strategy 2013[28]	The Strategy has been prepared to support the National Strategy for Flood and Coastal Erosion Risk Management in Wales under the Flood and Water Management Act 2010. The Strategy was developed to address potential flood risk arising from local sources within the boundaries of the Authority area. The Strategy states the authorities responsibilities for flood risk and proposed actions or policies to be introduced to manage flood risk including specifying objectives.
Dee River Basin Management Plan 2021-2027 Summary[29]	Under the Water Environment (Water Framework Directive) (England and Wales) Regulations 2017 a management plan is required for each River Basin District (RBD). The Dee River Basin Management Plan (RBMP) was first published in 2009 and updated in 2015. This document is part of the latest update to that plan which has been undertaken jointly between NRW and the Environment Agency to set out the programme of measures needed to achieve the objective of the WFD over the next six-year period (2021-2027).

[27] Flintshire Local Development Plan (FLDP) 2015-2030. Available at: https://www.flintshire.gov.uk/en/PDFFiles/Planning/Examination-Library-Documents/FINAL-LDP-Written-Statement-English.pdf. Accessed February 2025.
[28] Flintshire Local Flood Risk Management Strategy 2013. Available at: https://www.flintshire.gov.uk/en/PDFFiles/Flooding-and-Drainage/Flintshire-Local-Flood-Risk-Management-Strategy.pdf. Accessed February 2025.
[29] Natural Resources Wales and Environment Agency 2022. Dee River Basin Management Plan 2021 –2027 Summary. Available at: https://naturalresourceswales.gov.uk/media/695219/dee-rbmp-2021_2027-summary.pdf. Accessed February 2025.

7.3 Consultation

7.3.1 A summary of the key points raised during formal consultation and how this has been included in the design and assessment are provided in Table 7.4.

Table 7-4 Summary of formal consultation

Date of enquiry	Nature of enquiry	Date of response	Response to enquiry
11/09/2024	Meeting with NRW to discuss modelling requirements	24/09/2024	NRW confirmed the flood modelling situation, new LiDAR data availability and climate change allowance guidance[30],[31] for inclusion in modelling. Any updated modelling outputs were requested to be sent to NRW for review. No additional information has been received from NRW regarding the maintenance work in the upper catchment. Therefore, modelling has proceeded on the assumption that the latest NRW model for the Queensferry Drain represents the current condition of the watercourses. This is also stated in the Assumptions and Limitations section of the hydraulic modelling report [6,7]. Details for model inputs and outputs are included in the hydraulic modelling reports [6,7] and results discussed in the FCA[4].

[30] Welsh Government, 2021. Flood Consequences Assessments: Climate change allowances. Available online at: Flood Consequences Assessments: Climate change Accessed July 2025.
[31] Natural Resources Wales, 2022. Adapting to Climate Change: Guidance for Flood and Coastal Erosion Risk Management Authorities in Wales. Available online at: Adapting to Climate Change: Guidance for Flood and Coastal Erosion Risk Management Authorities in Wales Accessed July 2025.

18/12/2024	Request to NRW for response to EIA Scoping Report	31/01/2025	Response from NRW to contents of the IA Scoping Report. Key responses related to the road drainage and water environment include flood risk, physical processes and water quality and WFD. Flood risk: NRW agree that flood risk should be scoped in and be in accordance with TAN15[26]. The FCA[4] considers potential impacts on flood risk assets including Dee embankment and Queensferry Drain. Water quality and WFD: Consideration to the potential effects on WFD elements, protected site receptors and potential effects associated with contaminated water during construction and operation have been assessed in Section 7.8 and 7.9 of EIA Chapter 7: Road drainage and the water environment. Physical processes: consideration of baseline physical processes and the potential effects as a result of the Scheme have been considered in the Technical Appendix 7.E: Hydrodynamic and sediment modelling[5] and summarised within this chapter.

Date of enquiry	Nature of enquiry	Date of response	Response to enquiry
			Additional: A Flood Risk Activity Permit (FRAP) is required for working in and over a main river and Marine Licence will also be required for carrying out licensable activities within the marine licensable area. A Habitats Regulation Assessment (HRA) will be carried out to test if the proposal could harm a European site. WFD assessment also required.
13/01/2025	Request to NRW for further consultations for the Flood Modelling Scoping Reports	06/03/2025	NRW recommendations for amendments to the model and estimating QMED (the median annual maximum flood) and application of the WINFAP software for estimation of peak flows and flood frequency curves. Further information on the River Dee QMED estimate has been provided in the updated version of GN008 issued in March 2025. The update did not change the final peak flow estimates, therefore, no changes were required to the hydraulic model inputs.

Date of enquiry	Nature of enquiry	Date of response	Response to enquiry
10/02/2025	Request to NRW for clarity on comments received following NRW response to EIA Scoping Report including restrictive working practices in relation to 'in river' working.	21/02/2025	NRW identify the key issue is the potential for underwater noise and vibration to cause disturbance and potential disruption of fish features migration on the Dee. Therefore, NRW needs more information on the likely in river piling operations to construct the bridge piers and removal of the existing bridge piers. The details of construction activities are included in EIA Chapter 2: The Project. A detailed assessment of noise and vibration disturbance in relation to fish migration is provided in EIA Chapter 16: Marine environment.
06/03/2025	Meeting with NRW Items discussed: water sampling locations, screening distances in marine environment, tidal movements both up and downstream, plant access would be on the jack up barge.	06/03/2025	The water sampling locations and results are provided in the River Dee Surface Water Quality Baseline Report [1].

Date of enquiry	Nature of enquiry	Date of response	Response to enquiry
20/03/2025	Draft construction methodology sent to NRW with suggestions for mitigation measures for restricting any 'in river' working as described below: - Installation of pile casings in the river channel using non-percussive piling methods advised to be undertaken between 0800 – 1700hrs and no work in 3hr period leading up to high tide at Chester weir.	08/04/2025	NRW response agreeing to restrictive working in river to daytime only and avoidance of percussive piling techniques to reduce risks of noise and vibration causing disturbance to migratory fish. However, should percussive piling be deemed necessary this will require further consultation with NRW and assessment in the EIA chapter, including underwater noise modelling. A detailed assessment of noise and vibration disturbance in relation to fish migration is provided in EIA Chapter 16: Marine environment. The proposed demolition of the existing road bridge is advised to be included in the EIA under the 'Rochdale' envelope principle to ensure a realistic worst-case scenario is considered. This has been assessed in Section 7.8 of Chapter 7: Road drainage and the water environment.

7.4 Assessment Methodology

7.4.1 The scope of the assessment includes all water environment receptors that could potentially be adversely or beneficially impacted by the construction and operation of the Scheme.

7.4.2 A scoping assessment was carried out in 2024 to determine which environmental receptors should be scoped in or out of further assessment. The scope of the assessment has also been influenced by the consultation responses received since 2024 as set out in Table 7-4. The conclusions of the scoping assessment have been reviewed following the progression of the Scheme design development. Where no impact pathways were identified, these receptors have been scoped out of further assessment.

7.4.3 A summary of water environment receptors scoping is presented in Table 7.5.

Table 7-5 Summary of the road drainage and water environment scoping assessment

Receptor	Stage	Scoping outcome	Justification
Main Rivers (River Dee, Garden City Drain, Queensferry Drain, Sandycroft Drain)	Construction / Operational	Scoped in	Hydrologically connected to the Scheme.
Groundwater (Superficial Secondary (Undifferentiated) aquifer and bedrock Secondary A aquifer)	Construction / Operational	Scoped in	Hydrogeologically connected to the Scheme.
WFD water bodies (Dee (N. Wales) Transitional water body, Dee Carboniferous Coal Measures groundwater body and Garden City Drain and Sandycroft Drain surface water bodies.	Construction / Operational	Scoped in	Within the 2km study area (as defined in Section 7.4.22 and 7.4.23) and hydrologically and hydrogeologically connected to the Scheme.
Flood Risk: Scheme is classified as essential infrastructure	Operational	Scoped in	Scheme within high flood risk zone (tidal and river flooding)

Receptor	Stage	Scoping outcome	Justification
Designated sites (River Dee Site of Special Scientific Interest (SSSI) & Groundwater Dependent Terrestrial Ecosystems (GWDTE), River Dee & Bala Lake Special Areas of Conservation (SAC), Dee Estuary – Ramsar, Special Protection Area (SPA), SAC and SSSI)	Construction / Operational	Scoped in	Hydrologically and hydrogeologically connected to the Scheme
Ponds	N/A	Scoped out	Not hydrologically connected to the Scheme
Water bodies upstream of the Scheme: The Pentre Drain North, Pentre Drain South West and Daisy Bank Farm Drain.	N/A	Scoped out	Not hydrologically connected to the Scheme. The Queensferry Drain and Daisy Bank Farm Drain confluence is part of the Scheme however impacts at this location are assessed for Queensferry Drain only as no upstream impacts on Daisy Bank Farm Drain are anticipated.
Consented abstractions	N/A	Scoped out	Not within the study area and unlikely to be impacted beyond this distance.

Receptor	Stage	Scoping outcome	Justification
Consented discharges	N/A	Scoped out	The operation of these consented discharge sites within the study area would not be affected by the Scheme and the nature of the consented discharges should not change. The Scheme would also not affect flows within the receiving watercourses and the ability to dilute and disperse discharges.

Approach to Environmental Impact Assessment

7.4.4 This EIA for road drainage and the water environment has been undertaken in accordance with the[32] and DMRB LA104[33] to assess the likely significance of effects of the Scheme.

WFD assessment

7.4.5 The WFD assessment[2] has been undertaken using the Environment Agency "Clearing the Waters for All" guidance[34], which describes an approach for transitional water bodies. Professional judgement has also been used where appropriate. The WFD environmental objectives are outlined in Table 2-1 of the WFD Assessment[2]. In summary, to be WFD compliant the Scheme should not:

[32] Highways England et al., 2020c. Design Manual for Roads and Bridges (DMRB), LA 113 – Road drainage and the water environment, Available at: Design Manual for Roads and Bridges (DMRB), LA 113 . Accessed March 2025.
[33] Highways England et al., 2020. Design Manual for Roads and Bridges (DMRB), LA 104 - Environmental assessment and monitoring Available at: 0f6e0b6a-d08e-4673-8691-cab564d4a60a. Accessed March 2025.
[34] Environment Agency, 2016. Guidance: Water Framework Directive assessment: estuarine and coastal waters, "Clearing the waters for all". Available at: Water Framework Directive assessment: estuarine and coastal waters - GOV.UK Accessed March 2025.

a) Cause deterioration to any water bodies such that their status under the WFD, or the status of any of the constituent WFD quality elements, falls by one or more classes or, where the quality element is already in the lowest class, cause any deterioration of that element.

b) Contribute to, or cause, a failure of a water body to meet good overall status, or, in the case of an artificial or heavily modified water body, good ecological potential, and good chemical status.

c) Prevent future improvements from being implemented.

d) Breach the objectives and standards of protected area registered under Article 6 of the WFD.

7.4.6 Additionally, assessment of impacts on groundwater must be managed in accordance with relevant national legislation such as the Groundwater (Water Framework Directive) (Wales) Direction 2016[12].

HEWRAT Assessment

7.4.7 Water quality was assessed using the HEWRAT and Metal Bioavailability Assessment Tool (M-BAT) and is reported in the HEWRAT Assessment[3] for fluvial watercourses. The Scheme must be designed so that discharges from road run-off do not cause a deterioration in water quality within receiving surface waters, and do not exceed published Environmental Quality Standards (EQS).

Flood consequences assessment

7.4.8 Flood risk must be managed in accordance with relevant legislation requirements of the Lead Local Flood Authority. A FCA[4] was undertaken to identify the acceptability of flooding consequences in accordance with Planning Policy Wales[24] and TAN 15[26].

Hydrodynamic and sediment transport modelling

7.4.9 Hydrodynamic and Sediment Transport modelling[5] reported the predicted impacts of the new Bridge piers on the hydrodynamic regime and sediment transport in the Dee.

Methodology

7.4.10 The predicted significance of the effect for the construction and operational phase of the Scheme on road drainage and the water environment was determined through a standard method of assessment described in EIA Chapter 4: Approach to Environmental Assessment. The assessment was based on professional judgement and guidance documents taking account of:

i) Sensitivity of the receiving water environment.

ii) Potential magnitude of change.

iii) Significance of the effect occurring.

Sensitivity of the receiving water environment

7.4.11 The DMRB: LA113 guidance[32] provides a standard approach to the assessment of significance of water environment effects. Table 7-6 has been used from the DMRB methodology to estimate the importance of water environment receptors.

Table 7-6 Water environment sensitivity criteria

Importance (sensitivity)	Typical criteria	Typical examples	Criteria
Very High	Nationally significant attribute of high importance	Surface water	Watercourse having a WFD classification shown in an RBMP and Q95 <1.0m^3/s. Site protected/designated under EC or UK legislation (SAC, SPA, SSSI, Ramsar site, salmonid water) / Species protected by EC legislation LA 108.
Very High	Nationally significant attribute of high importance	Groundwater	Principal aquifer providing a regionally important resource and/or supporting a site protected under EC and UK legislation. Groundwater locally supports GWDTE. Source Protection Zone (SPZ) 1.
Very High	Nationally significant attribute of high importance	Flood risk	Essential infrastructure or highly vulnerable development

Importance (sensitivity)	Typical criteria	Typical examples	Criteria
High	Locally significant attribute of high importance	Surface water	Watercourse having a WFD classification shown in a RBMP and Q95 <1.0m^3/s. Species protected under EC or UK legislation.
High	Locally significant attribute of high importance	Groundwater	Principal aquifer providing a locally important resource or supporting river ecosystem. Groundwater locally supports GWDTE. SPZ2.
High	Locally significant attribute of high importance	Flood risk	More vulnerable development.

Importance (sensitivity)	Typical criteria	Typical examples	Criteria
Medium	Of moderate quality and rarity	Surface water	Watercourses not having a WFD classification shown in a RBMP and Q95 <0.001m^3/s. Sites that have been designated for ecological value by local councils (i.e., local wildlife site (LWS) & local nature reserve (LNR).
Medium	Of moderate quality and rarity	Groundwater	Aquifer providing water for agricultural or industrial use with limited connection to surface water. SPZ3.
Medium	Of moderate quality and rarity	Flood risk	Less vulnerable development.
Low	Lower quality	Surface water	Watercourses not having a WFD classification shown in a RBMP and Q95 <0.001m^3/s.
Low	Lower quality	Groundwater	Unproductive strata.
Low	Lower quality	Flood risk	Water compatible development.

Source: DMRB LA 113 – Road drainage and the water environment Revision 1. Table 3.70

Potential magnitude of change

7.4.12 The magnitude of change of impact on a receptor is independent of its sensitivity and will be determined through professional judgement, DMRB guidance[32] and informed by relevant quantitative and semi-quantitative data (e.g. flood modelling results), where appropriate.

7.4.13 Table 7.7 sets out the criteria that will be used to estimate the magnitude of effect. The magnitude of the effect considers the timing, scale, size and duration of the potential effect and the probability of the effect occurring.

Table 7-7 Estimating the magnitude of impact on an attribute – water environment

Magnitude	Criteria	Typical examples	Examples
Major adverse	Results in loss of attribute and/or quality and integrity of the attribute	Surface water	Loss or extensive change to a fishery. Loss of regionally important public water supply. Loss or extensive change to a designated nature conservation site. Reduction in water body WFD classification.
Major adverse	Results in loss of attribute and/or quality and integrity of the attribute	Groundwater	Loss or extensive change to an aquifer. Loss of regionally important water supply. Loss or extensive change to the GWDTE or baseflow contribution to protected surface water bodies. Reduction in water body WFD classification. Loss or significant damage to major structure(s) through subsidence or similar effects.
Major adverse	Results in loss of attribute and/or quality and integrity of the attribute	Flood risk	Increase in peak flood level (> 100mm).

Magnitude	Criteria	Typical examples	Examples
Moderate adverse	Results in some measurable change in attributes, quality or vulnerability	Surface water	Partial loss in productivity of a fishery. Degradation of regionally important public water supply or loss of major commercial / industrial / agricultural supplies. Contribution to reduction in water body WFD classification.
Moderate adverse	Results in some measurable change in attributes, quality or vulnerability	Groundwater	Partial loss or change to an aquifer. Degradation of regionally important public water supply or loss of significant commercial / industrial / agricultural supplies. Partial loss of the integrity of GWDTE. Contribution to reduction in water body WFD classification. Damage to major structure(s) through subsidence or similar effects or loss of minor structure(s).
Moderate adverse	Results in some measurable change in attributes, quality or vulnerability	Flood risk	Increase in peak flood level (> 50mm).
Minor adverse	Results in some measurable change in attributes, quality or vulnerability	Surface water	Minor effects on water supplies.

Magnitude	Criteria	Typical examples	Examples
Minor adverse	Results in some measurable change in attributes, quality or vulnerability	Groundwater	Minor effects on an aquifer, GWDTEs, abstractions and structures.
Minor adverse	Results in some measurable change in attributes, quality or vulnerability	Flood risk	Increase in peak flood level (> 10mm).
Negligible	Results in some measurable change in attributes but of insufficient magnitude to affect the use or integrity	Surface water	No measurable impact upon surface water receptors
Negligible	Results in some measurable change in attributes but of insufficient magnitude to affect the use or integrity	Groundwater	No measurable impact upon an aquifer and/or groundwater receptors

Magnitude	Criteria	Typical examples	Examples
Negligible	Results in some measurable change in attributes but of insufficient magnitude to affect the use or integrity	Flood risk	Negligible change to peak flood level (<+/- 10mm).
Minor beneficial	Results in some beneficial effect on attribute or a reduced risk of negative effect occurring	Surface water	Localised improvements to the WFD classification
Minor beneficial	Results in some beneficial effect on attribute or a reduced risk of negative effect occurring	Groundwater	Reduction of groundwater hazards to existing structures. Reductions in waterlogging and groundwater flooding.

Magnitude	Criteria	Typical examples	Examples
Minor beneficial	Results in some beneficial effect on attribute or a reduced risk of negative effect occurring	Flood risk	Creation of flood storage and decrease in peak flood level (>10mm).
Moderate beneficial	Results in moderate improvement of attribute quality	Surface water	Contribution to improvement in water body WFD classification.
Moderate beneficial	Results in moderate improvement of attribute quality	Groundwater	Contribution to improvement in water body WFD classification. Improvement in water body catchment abstraction management strategy (or equivalent) classification. Support to significant improvements in damaged GWDTE.
Moderate beneficial	Results in moderate improvement of attribute quality	Flood risk	Creation of flood storage and decrease in peak flood level (>50mm).

Magnitude	Criteria	Typical examples	Examples
Major beneficial	Results in major improvement of attribute quality	Surface water	Removal of existing polluting discharge or removing the likelihood of polluting discharges occurring to a watercourse. Improvement in water body WFD classification.
Major beneficial	Results in major improvement of attribute quality	Groundwater	Removal of existing polluting discharge to an aquifer or removing the likelihood of polluting discharges occurring. Recharge of an aquifer. Improvement in water body WFD classification.
Major beneficial	Results in major improvement of attribute quality	Flood risk	Creation of flood storage and decrease in peak flood level (>100mm).
No change		No loss or alteration of characteristics, features or elements; no observable impact in either direction.	

Source: DMRB LA 113 Road drainage and the water environment Revision 1. Table 3.71

Assessment of significance

7.4.14 The significance of an effect is determined by considering the sensitivity of the receptor alongside the magnitude of the impact, as well as professional judgement. The effect could be 'beneficial' or 'adverse', and the significance graded in accordance with the matrix presented in Table 7.8. All effects that are noted as 'Moderate' or above are considered as significant for the purpose of this report, as defined by the red border in the below table.

Table 7-8 Significance of effects matrix

		Magnitude of potential impact (Degree of change)				
		No change	**Negligible**	**Minor**	**Moderate**	**Major**
Environmental Value (Sensitivity)	**Very High**	Neutral	Slight	Moderate or Large	Large or Very Large	Very Large
	High	Neutral	Slight	Slight or Moderate	Moderate or Large	Large or Very Large
	Medium	Neutral	Neutral or Slight	Slight	Moderate	Moderate or Large
	Low	Neutral	Neutral or Slight	Neutral or Slight	Slight	Slight or Moderate
	Negligible	Neutral	Neutral	Neutral or Slight	Neutral or Slight	Slight

Source: DMRB LA 104 Environmental assessment and monitoring Revision 1. Table 3.8.1

Assumptions and limitations

7.4.15 This chapter has been prepared using publicly available surface and groundwater information for desk based assessment. Surveys have been undertaken to support and validate (where applicable) this information. Where this has not been possible, it is assumed the information provided from public sources is correct and reflects baseline conditions.

7.4.16 Bathymetric surveys carried out in 2021 and 2022 may not have captured the full dynamic range of bed elevation variations, and the temporal variability in bed elevation may have been even greater than that measured.

7.4.17 Water quality samples collected on a monthly basis between November 2024 and April 2025 only provide a snapshot of the water chemistry conditions at the time and depth for the sample which was obtained.

7.4.18 Assumptions and limitations specific to supporting information are detailed in the relevant technical appendices.

7.4.19 It is assumed that a water feature (surface water or groundwater) cannot be assigned a sensitivity classification of 'negligible' due to the conservation value of water resources as defined by the Water Resource Act 1991[12].

Design Assumptions

7.4.20 The assessment is based on the scheme description presented in EIA Chapter 2: The Project. At the time of writing, assumptions on design details relevant to the road drainage and water environment have been made to inform this assessment, and these are given below:

a) The existing bridge is proposed to be replaced with a similar structure with a span of approximately 140 metres and a width of 36.5 metres supported by two sets of river piers. Each river pier would be constructed using 12 No. piles approximately 1.5 metres in diameter. The river piers would be in a similar orientation as the existing and distance from the top of each riverbank.

b) The existing A494 bridge is expected to be decommissioned with the bridge deck removed. The existing river piers would remain in-situ and may be modified in the future to improve their aesthetic appearance. The existing gantry that spans the A494 road corridor on the east side of the bridge would also be removed as well as the existing carriageway. The existing bridge abutments would be removed and banks graded back.

c) An extensive network of drainage pipes, culverts and ditches would be constructed to collect the runoff from the paved highway and embankment slopes, and to drain the lower layers of the road construction. West of the River Dee these would discharge to the Queensferry Drain channel to the new pumping station to discharge to the River Dee. East of the River Dee the new section of carriageway would be drained into the existing network and via the swale to the Manor Drain/ Garden City Drain.

d) Queensferry Drain will be diverted to enable the construction of the replacement bridge and the A494 road corridor, new sections of open channel will be provided either side of the railway with a section of existing culvert beneath the railway line being retained.

e) A new drainage outfall to the River Dee will be created to replace the existing outfall.

Study area

7.4.21 The study area for the road drainage and water environment covers a 2 km radius and any water bodies outside of this which are hydrologically connected to the Scheme as shown on Volume 2, Figure 7.1.

7.4.22 Water bodies outside the 2 km buffer were identified during the assessment, based on professional judgement of their sensitivity and connectivity to the Scheme area. This approach ensures that any potential effects of the Scheme are proportionately identified.

Baseline information sources

7.4.23 A number of sources (surveys, supporting reports and publicly available data) as detailed in the following section were used to provide information on baseline conditions for the water environment.

Surveys

a) 6 months of baseline water quality surveys (November 2024 to April 2025) at five locations (three on the River Dee upstream and downstream of the Scheme; one on Queensferry Drain and one on Garden City Drain) detailed in the Technical Appendix 7:A, River Dee Surface Water Baseline Report[1].

b) Bathymetric surveys encompassing the area from upstream of the Scheme at the weir at Chester to the training wall downstream of the Scheme near Lead Brook (9th September 2021 to 26th May 2022)[36].

c) Surveyed current, salinity, and suspended solids measurements were obtained from two survey locations. Site A is located on the upriver (eastern) side of the Flintshire Bridge and Site B is located on the upriver (eastern) side of the A494 existing Queensferry bridge (August 2021) [36].

d) Surface water site walkover was carried out along Queensferry Drain (19 November 2024).

Supporting Reports

a) Drome Corner to Ewloe Particle Distribution Analysis[35] used in the hydrodynamic and sediment modelling[5].

b) A494 Dee Survey Data Report[36] detailing the current, salinity, and suspended solids measurements obtained.

c) Report on ground investigation without Geotechnical Evaluation – A494 River Dee Bridge Improvement[37] used to inform baseline geological conditions underlying the Scheme.

d) River Dee Flood Modelling - Preferred Option Report[i] to inform understanding of flood risk[4] and the drainage design.

e) Queensferry Drain Flood Modelling - Preferred Option Report[ii] to inform understanding of flood risk[4] and the drainage design.

f) Drainage Strategy[38] detailing the existing and proposed drainage design for the Scheme.

Publicly available data

a) National Library of Scotland historical georeferenced OS maps[39]

b) British Geological Survey (BGS) Geology of Britain Viewer[40]

c) Data Map Wales[41]

d) Catchment Data Explorer[42]

e) Magic Maps [43]

f) National River Flow Archive[44]

g) Climate averages[45]

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[35] Soil Mechanics, 2007. Drome Corner to Ewloe Particle Distribution Analysis.

[36] Partrac Ltd. 2021. A494 Dee Survey Data Report. Document reference: M5006.05.03.D01.V01.

[37] Furgo, 2019. Report on Ground investigation without Geotechnical Evaluation – A494 River Dee Bridge Improvement. Overwater Ground Investigation. Document No. G190001U(02).

[38] Mott MacDonald, 2025. A494 River Dee Bridge Replacement. Highway Drainage Developed Design Strategy Report. 100395318-002 | P01 | 395318-MMD-00-XX-RP-D-0007

[39] National Library of Scotland, 2024. Side by Side. Available online at: Side by side georeferenced maps viewer - Map images - National Library of Scotland (nls.uk). Accessed January 2025.

[40] British Geological Survey (BGS), 2024. Geology of Britain Viewer. Available online at: https://www.bgs.ac.uk/map-viewers/geoindex-onshore/. Accessed January 2025.

[41] Llywodraeth Cymru, Welsh Government, 2025. Data Map Wales. Available online at: New map | DataMapWales Accessed May 2025.

[42] Environment Agency, 2024. Dee Estuary Operational Catchment. Available online at: Dee Estuary Operational Catchment | Catchment Data Explorer. Accessed January 2025.

[43] DEFRA, 2024. Magic Map Viewer. Available online at: Magic Map Application (defra.gov.uk). Accessed January 2025.

[44] NFRA, 2024. Station Data. Available online at: NRFA Station Data for 67027 - Dee at Ironbridge (ceh.ac.uk). Accessed January 2025.

[45] Met Office, 2025. Location specific long term averages. Available at: Hawarden Airport Location-specific long-term averages. Accessed March 2025.

h) Cycle 3 (2021) Rivers and Waterbodies Map[46]

i) Bing Ordnance Survey (OS) mapping[47]

j) Flood and Coastal Erosion Risk Maps[48]

7.5 Baseline Conditions

Land use and topography

7.5.1 The study area is located within North Wales within the Flintshire County Council. The land use within the study area is a mixture of urban (industrial, commercial and residential) and rural land use.

7.5.2 Within the Scheme boundary lies the existing A494 carriageway and bridge, as well as an area of arable use on the right bank adjacent to the A494 carriageway. Immediately surrounding the Scheme footprint are a water treatment works and industrial, commercial and residential developments.

7.5.3 The existing A494 provides a critical transport link for North Wales linking Queensferry and Ellesmere Port. The North Wales Main Line railway also intersects the study area.

7.5.4 The existing A494 route is identified as a safeguarded road scheme in the Local Development Plan[23]. The Scheme has been safeguarded to enable it to be delivered over the planned period.

7.5.5 The Scheme is located in a low-lying coastal area, with elevations within the study area varying from approximately 0m AOD to 20m AOD.

Hydrology

7.5.6 There are a number of surface water receptors within the 2 km study area classified by NRW as main rivers[41] including:

a) River Dee (tidal reach)

[46] NRW, 2024. Cycle 3 (2021) Rivers and Waterbodies Map. Available online at: https://waterwatchwales.naturalresourceswales.gov.uk/en/. Accessed January 2025.
[47] Microsoft Bing, 2024. Maps. Available online at: Bing Maps - Directions, trip planning, traffic cameras & more. Accessed January 2025.
[48] Natural Resources Wales, 2025. Flood and Coastal Erosion Risk Maps. Available online at: Flood and Coastal Erosion Risk Maps. Accessed January 2025.

b) Queensferry Drain
c) Garden City Drain West/ Manor Drain
d) Rowleys Gutter
e) Beeches Drain Dee
f) Sandycroft Drain North
g) Finchett's Gutter

7.5.7 The following surface water bodies have been scoped out during the EIA Scoping Assessment, as they are located upstream of the Scheme and are unlikely to be impacted: The Pentre Drain North, Pentre Drain South West, and Daisy Bank Farm Drain.

7.5.8 The Scheme is located on a tidal reach of the River Dee/ Afon Dyfrdwy at National Grid Reference (NGR) SJ323685 as shown on Volume 2, Figure 7.1.

7.5.9 The headwaters of the River Dee originate in Eryri National Park and flow into Llyn Tegid and the valleys of Corwen and Llangollen in Wales. The River Dee then meanders northwards through the Cheshire Plain in England. The river has been significantly modified downstream of Chester Weir where it has been historically canalised within the tidal reach during the 1730s. The River Dee discharges into the Liverpool Bay. The River Dee has a total catchment area of approximately 2,251 km^2.

7.5.10 The closest gauging station (recorded by the National River Flow Archive (NRFA)[10]) to the Scheme on the River Dee is '67033- Dee at Chester Suspension Bridge' upstream of Chester Weir. The gauge has not recorded data since 2013 due to problems with equipment. The next closest gauging station is '67027- Dee at Ironbridge' located approximately 19.5 km upstream of the Scheme. The NRFA notes that abstractions cause flows at station 67033 to be about 6 m^3/s lower than station 67027. Flow data was taken upstream from the tidally influenced reach, whereas flows at the Scheme will be tidally influenced.

7.5.11 The average tidal prism in the Dee Estuary is 4x108 m^3, representing a volumetric increase of over 80% between mean low water and mean high water. As the mean river discharge of 31m^3/s is comparatively small, the estuary is tide-dominated,

with the freshwater river discharge contributing only around 0.35% of the tidal prism over the tidal cycle[5].

7.5.12 At the A494 bridge, a radar tide gauge was installed by Partrac in 2021 which recorded the water surface elevation every 6 minutes (m Ordnance Datum Newlyn (ODN)). Results indicate that spring and neap tides cause significant variation in water surface elevation at the proposed bridge location. The larger spring tides (greater than the mean) fluctuate over the tidal cycle and increase up to +5m ODN approximately. Further out in the Dee estuary the surface elevation change is much larger (9m on spring tides).

7.5.13 Speed was measured at two sites (Site A and Site B)[36] during spring and neap tides in August 2021[29]. Higher current speeds during the flood tide are recorded at both sites, with the maximum current velocity at the surface reaching almost 2.5 m/s during the peak flood flow.

7.5.14 Queensferry Drain is a main watercourse and is not designated as a WFD water body. The watercourse is currently culverted and receives drainage from the existing A494 road network. The pumping station operated by NRW pumps flows in the Queensferry Drain into the River Dee during periods of high tide when the outfall becomes tidally locked.

Climate

7.5.15 The nearest MET office gauge is Hawarden Airport which is approximately 3.5 km south east of the Scheme and is therefore considered representative of the Scheme's climate. The annual average rainfall amount recorded (1991 to 2020) was 729 mm[45].

Geology and hydrogeology

7.5.16 Detailed information relating to geology and soils assessment is included in EIA, Volume 1, Chapter 6: Geology and Soils.

7.5.17 In summary, the Scheme is underlain by mudstone and sandstone dominated bedrock consisting of the bands of the Etruria Formation (mudstone, sandstone and conglomerate), Pennine Middle Coal Measures Formation (mudstone,

siltstone and sandstone) and Pennine Lower Coal Measures Formation (mudstone, siltstone and sandstone)[40] as shown in Figure 6.2: Bedrock Geology.

7.5.18 The superficial deposits[40] underlying the Scheme and the study area on the right bank are predominantly tidal flat deposit consisting of clay, silt, sand and gravel[40]. These are anticipated to be approximately 15 m thick underlying the proposed bridge[49]. The study area south west of Chester Road is primarily Till, Devensian-diamicton with localised deposits glaciofluvial deposits, Devensian - sand and gravel[40]. Superficial deposits are shown in Figure 6.1: Superficial Geology.

7.5.19 The Scheme is underlain by a Secondary A bedrock aquifer (shown in Figure 6.4: Bedrock aquifer designation) and Secondary (undifferentiated) superficial aquifer (shown in Figure 6.3: Superficial aquifer designation) which are classified as 'High' groundwater vulnerability[40]. This suggests that the aquifers are capable of supporting water supplies at a local rather than strategic scale and, potentially forming an important source of base flow to rivers. There is likely to be some horizontal movement of groundwater through permeable sand and gravel layers. Vertical movement of the groundwater would be impeded by impermeable clay layers that are interbedded with the granular material. Bedrock is likely to be impermeable through the mudstone. There is common faulting in the area that could act as groundwater pathways.

7.5.20 All groundwater bodies in Wales are designated as Drinking Water Protected Areas[41]. The nearest SPZ is located approximately 3.4km east of the study area[41].

7.5.21 Due to the presence of Coal Measures beneath the Scheme[40], there is potential for coal seams to be present near or at the Scheme, which could act as primary groundwater pathways.

7.5.22 EIA Chapter 6: Geology and soils details the baseline environment for potentially contaminated land. Adjacent to the eastern bank of the River Dee is a section where potential for contamination is likely to be present due to historic activities including coal storage, ship building, a tarmacadam works, sewage works,

[49] Mott MacDonald. 2018. A494 River Dee Bridge Improvement – Preliminary Sources Study Report, ref. 395318-0044-B, dated 06/09/2018

chemical works and a tank cleaning operation. Extensive ground and groundwater contamination has been reported for the former Neston Tank Cleaning site, immediately south of the River Dee. A plan of the potentially contaminative land uses and environmental incidents within 500 m of the Scheme is shown in Figure 6-6: Potentially Contaminated Land.

Drainage

7.5.23 A detailed summary of existing highways drainage is provided in the Drainage Strategy Report[50]. CCTV drainage surveys of the Queensferry Drain culvert were carried out by Draintech in 2010. The existing drainage for the A494 is assumed to consist of a network of kerbs and gullies connected to carrier drains. All discharges are untreated with no attenuation and are anticipated to enter the Queensferry Drain at various points.

7.5.24 On the eastbound carriageway to the north of the River Dee, the majority of existing drainage is discharged to a vegetated open channel (swale) which drains to the north to connect with the Garden City Drain/ Manor Drain. A portion of the network outfalls to an existing manhole on the north side of the carriageway approximately 300m east of the river on Claremont Avenue, the destination beyond this point is unknown.

7.5.25 The River Dee is the final receiving watercourse for all drainage derived from the existing A494 bridge and carriageway.

Water quality

7.5.26 Water quality spot samples were obtained on a monthly basis between November 2024 and April 2025 at 3 locations on the River Dee (upstream and downstream of the Scheme), 1 location on Queensferry Drain and 1 location on Garden City Drain. The sampling suite was chosen to help understand the baseline concentrations of parameters of interest that could be affected by the Scheme.

[50] Mott MacDonald, 2025. A494 River Dee Bridge Replacement. Highway Drainage Developed Design Strategy Report. 100395318-002 | P01 | 395318-MMD-00-XX-RP-D-0007

Discussion of limitations of the sampling programme is provided in the River Dee Surface Water Quality Baseline Report [1].

7.5.27 The data showed elevated baseline concentrations above EQS thresholds of several parameters of interest such as zinc and chromium IV indicative of the presence of pollution sources. Other parameters such as suspended solids were highly variable, however due to the dynamic tidal nature of the River Dee it is unclear of the extent of the influence of anthropogenic sources or natural processes. Presentation of baseline results and analysis is provided in the River Dee Surface Water Quality Baseline Report [1].

7.5.28 Salinity measurements were obtained as time-series, vertical profiles, and transects simultaneously with the current measurement. Salinity vertical profiles show homogeneous vertical mixing on all profiles except for High Water (HW)-0.5 to HW+0.5 hours, where slightly fresher water was observed at the surface. Further information is provided in the A494 Dee Survey Data Report[36].

7.5.29 Temperature measurements were also obtained as time-series, vertical profiles and spanwise transects with the salinity and currents measurements. temperature variation over the tidal cycle is of the order of 1 ºC. Further information is provided in the A494 Dee Survey Data Report report[36].

Designated sites

7.5.30 A number of designated sites[43] are located within the 2 km study area[41] or hydrologically linked to the Scheme as detailed in Table 7.9 below and shown in Figure 16.1. Further details of sensitive habitats present within the study area are provided in Volume 1, EIA Chapter 8: Terrestrial Ecology and Chapter 16: Marine Ecology.

Table 7-9 Protected sites within 2 km or hydrologically linked to the Scheme

Site	Designation	Reasons for designation	Distance from Scheme
River Dee and Bala Lake/ Afon Dyfrdwy a Llyn Tegid	SAC - UK	Designated for its coastal habitats and fish species	Within the Scheme footprint
River Dee/ Afon Dyfrdwy	SSSI	Designated for its fluvial geomorphology, carboniferous geology, range of river habitat types and fish species	Within the Scheme footprint
Shotwick Brook NVZ	Nitrate Vulnerable Zone	Area at risk from agricultural nitrate pollution	Within the Scheme footprint
Dee Carboniferous Coal Measures	Groundwater Drinking Water Protected Areas	Area not at risk (2020)	Underlying the Scheme
The Dee Estuary	Ramsar site	Designated for its bird species, wetland habitat saltmarsh, intertidal mudflats and sandflats	Approximately 1.0 km northwest of Scheme (tidally linked)
The Dee Estuary	SPA - UK	Designated for its wintering, breeding and migratory bird assemblages	Approximately 1.0 km northwest of Scheme (tidally linked)
Dee Estuary/ Aber Afon Dyfrdwy	SAC -UK	Designated for its mudflats, coastal habitats and fish species	Approximately 1.0 km northwest of Scheme (tidally linked)
Dee Estuary/ Aber Afon Dyfrdwy	SSSI	Designated for its wintering bird populations and coastal habitat	Approximately 1.0 km northwest of Scheme (tidally linked)
Dee West	Urban Wastewater Treatment Regulations sensitive shellfish waters	Sensitive shellfish waters	Approximately 9km northwest of Scheme (tidally linked)

Aquatic ecology

7.5.31 The Dee Estuary supports a diverse array of marine life including fish and invertebrates, particularly within its extensive intertidal mudflat and sandflat habitats. Further detail on the baseline habitats and species can be found in Volume 1, EIA Chapter 16: Marine Ecology.

7.5.32 Areas within the intertidal habitats are used for roosting, foraging and refuge. The adjacent fields and sand bars are used for high tide refuge, depending on food availability and the state of the tide by species of interest including breeding waterfowl and waders.

7.5.33 Fish species migrate through the study area on the Dee include those which are features of interest of the designated sites. This includes Atlantic salmon (*Salmo salar*), sea lamprey (*Petromyzon marinus*), river lamprey (*Lampetra fluviatilis*) and European smelt (*Osmerus eperlanus*).

7.5.34 Invasive Non-Native Species (INNS) are potentially present including Chinese Mitten Crab (*Eriocheir sinensis*) as detailed in Volume 1, EIA Chapter 16 Marine Ecology.

Water Framework Directive

7.5.35 Two WFD water bodies were screened in by the WFD Assessment[2] as being potentially impacted by the Scheme:

a) Dee (N.Wales) transitional WFD water body water body (ID: GB531106708200).

b) Dee Carboniferous Coal Measures WFD groundwater body (ID GB41102G204800).

7.5.36 Further information on the baseline for these WFD water bodies is provided in the WFD Assessment[2].

7.5.37 WFD Protected Areas are those designated under other EU Directives that have been transposed to the main WFD legislation and those designated under the Habitats and Species Regulations 2017.

7.5.38 The following designated sites were screened in by the WFD Assessment[2]:

a) River Dee and Bala Lake/ Afon Dyfrdwy a Llyn Tegid SAC
b) River Dee/ Afon Dyfrdwy SSSI
c) Shotwick NVZ
d) Dee Carboniferous Coal Measures DWPA
e) The Dee Estuary Ramsar
f) The Dee Estuary SPA
g) Dee Estuary/ Aber Afon Dyfrdwy SAC
h) Dee Estuary/ Aber Afon Dyfrdwy SSSI.

Flood Risk

7.5.39 A high level summary of the published NRW and TAN15[26] flood maps for the Scheme is provided below. A detailed FCA[4] has been prepared for the Scheme.

7.5.40 The NRW 'Flood Risk from Rivers' map[48] identifies the risk of flooding is mostly within the extents of the River Dee (tidal and fluvial flooding) and the Queensferry Drain open channel watercourse (fluvial) as shown in Volume 2, Figure 7.4.

7.5.41 NRW's 'Flood Risk from the Sea' map[48] identifies a high risk of flooding within the extents of the River Dee. Flood risk from the sea is shown in Volume 2, Figure 7.3. Areas of low and medium flood risk extend to within the flat low lying areas surrounding the Scheme. This high-risk area is shown to be flanked by flood defences (embankments).

7.5.42 The NRW 'Flood Risk from Surface Water & Small Watercourses'[48] map identifies several discrete areas of low, medium and high surface water flood risk. This includes an area of high risk at the low point in the existing A494 carriage beneath the Network Railway overbridge and also the highway drainage swale south of the existing A494 carriageway as shown in Volume 2, Figure 7.5.

Physical processes

Hydromorphology

7.5.43 The river has extensive anthropic influence including abstractions and impoundment upstream of the study area, as well as canalisation and flood defence embankments within the study area[39].

7.5.44 The Scheme is located within the Afon Dyfrdwy (River Dee) SSSI which is of special interest for its fluvial geomorphology, carboniferous geology, range of river habitat types, saltmarsh transition habitats and species of interest[41].

7.5.45 Within the study area at the proposed bridge location, the banks on both sides are steep with the inter tidal areas consisting primarily of saltmarsh habitat dominated by fine sediment.

Sediment transport

7.5.46 Assessment of sediment transport is detailed in Hydrodynamic and sediment transport modelling[5]. In summary, the transport of sediments upstream by the flood tide dominates when river discharge is low, resulting in net upstream sediment transport accretion.

7.5.47 The flood tide dominance is reversed when the river discharge is high in combination with the ebb tide, leading to net downstream sediment transport and erosion. Flood tidal current speeds are higher than the ebb currents in the Dee Estuary. This asymmetry results in the net importation and retention of sediment within the estuary. Further details are provided in Hydrodynamic and sediment transport modelling[5].

Bed level changes

7.5.48 A detailed analysis of measured changes between bathymetry surveys undertaken in 2021 and 2022 is provided in the Hydrodynamic and sediment transport modelling[5].

7.5.49 Sediments tend to accumulate in front of and downstream of the existing A494 and Jubilee Bridge piles and towards the middle of the channel. Upstream of the existing piles, bed levels tend to decrease due to the high flow speeds and flow interactions with the structures. It is considered that the turbulence and related high bed shear stresses generated by these interactions results in the erosion observed upstream of the structures[5].

7.5.50 In this regime, the sediments accumulate upstream of the A494 and Jubilee Bridge piles and towards the centre of the channel. Erosion occurs downstream of the piles due to turbulence generated by flow interactions with the structures. Low ebb tide water levels were recorded to increase by almost 1 m during high river discharge events[5].

7.5.51 Around the existing piles localised bed elevation changes of +/-1.8 m were observed over a relatively short period between survey visits. Existing scour holes were observed up to 3 m below the bed level in the main channel[5].

Sediment size

7.5.52 Particle size analysis on sampled material[35], borehole and grab samples[37] and publicly available BGS borehole information[40] nearby the Scheme indicate that sediment near the Scheme is dominated by fine/medium sand material. Results indicate sediment material is slightly coarser towards the centre of the channel and finer in the intertidal areas. Further details are provided in the Hydrodynamic and sediment transport modelling[5].

Suspended solids

7.5.53 Measured suspended sediment concentrations[36] at the Scheme were derived from turbidity measurements obtained simultaneously as the salinity, temperature and current measurement. Higher total suspended solid values were measured near the bed (approximately double the near-surface values). Higher concentrations are recorded during ebb tide and also during peak flood due to the higher current speeds. Further details are provided in Hydrodynamic and sediment transport modelling report[5].

7.6 Future baseline

7.6.40 Several areas are included in the FLDP[27] as a “green wedge”. In line with Policy EN11, development will only be permitted under specific criteria detailed where the new land use will not have an impact on the openness of the green wedge. Areas covered by this within the study area include the Sealand area southeast of the A494 on the northern bank of the River Dee and several areas south east of the A494 on the south side of the River Dee between B5129 and the Borderlands Line railway.

7.6.41 Land north west of the existing River Dee Bridge is allocated for Northern Gateway strategic site (policy STR3A LDP[27]), as mixed use (employment, housing, commercial, community facilities) development site. Construction has commenced and this has been considered as part of the baseline assessment.

7.6.42 Climate change is anticipated to affect river levels as a result of extreme rainfall events, however, there is considerable uncertainty regarding magnitude of change. Mean sea level rise by 2100 in comparison to the assessed baseline (1981 to 2000) is anticipated to be 0.76m (70th percentile for design allowance) and 1.03m (90th percentile for sensitivity planning) in Flintshire[51]. NRW ‘flood risk map for planning’ includes allowance for climate change scenarios. These maps are provided in the FCA[4].

Assessment of receptor sensitivity

7.6.43 The following receptors located within the study area were scoped out of further assessment:

a) Rowleys Gutter: the confluence with the River Dee is greater than 1km downstream of the Scheme and no works are proposed within the catchment.

b) Wepre Brook: confluence with the River Dee is located >2km downstream from the Scheme and is unlikely to be impacted at this distance in tidally influenced reaches with attenuation processes occurring and no works are proposed within the catchment.

[51] Welsh Government, 2022. Adapting to Climate Change: Guidance for Flood and Coastal Erosion Risk Management Authorities in Wales. Available online: Adapting to Climate Change: Guidance for Flood and Coastal Erosion Risk Management Authorities in Wales Accessed March 2025.

c) Sandycroft Drain and Finchett's Gutter: both WFD water bodies have a confluence with the River Dee approximately 1.7km upstream of the Scheme. At this distance and with attenuation processes occurring it is unlikely these watercourses will be impacted by the Scheme in tidally influenced reaches and no works are proposed within the catchment.

d) Pentre Drain North, Pentre Drain South West, and Daisy Bank Farm Drain: scoped out during the EIA Scoping Assessment as they are upstream of the Proposed Scheme and unlikely to be impacted.

e) Dee West Urban Wastewater Treatment Regulations Sensitive Shellfish Waters: located approximately 9km downstream of the Scheme and are unlikely to be impacted at this distance in tidally influenced reaches with attenuation processes occurring.

A summary of scoped in receptor sensitivity is outlined in Table 7-10 .

Table 7-10 Potential receptor sensitivity

Type	Receptor	Description	Sensitivity
Transitional water body	River Dee (tidal reach)	Site protected/designated under EC or UK legislation (Ramsar, SPA, SAC, SSSI). Water body has a WFD classification shown in a RBMP.	Very High
Surface water body	Queensferry Drain	Watercourse does not have a WFD classification shown in a RBMP and assumed Q95 of >0.001m3/s.	Medium
Surface water body	Garden City Drain West/ Manor Drain	Watercourse having a WFD classification shown in a RBMP (ID: GB111067056960) and Q95 of >1 m3/s.	High
Groundwater body	Dee Carboniferous Coal Measures	Water body is a WFD water body (ID: GB41102G204800) with an overall status of Poor. All groundwater bodies in Wales are designated as Drinking Water Protected Areas.	High
Groundwater	Shallow groundwater	Secondary (undifferentiated)	Low
Flood risk	Transport	Less vulnerable development*	Medium
Flood risk	Commercial	Less vulnerable development*	Medium

Type	Receptor	Description	Sensitivity
Flood risk	Residential	Essential or highly vulnerable*	Very High
Flood risk	Pastoral Agriculture	Less vulnerable development*	Medium

*Flood risk receptor sensitivity based on TAN15[26] for vulnerable developments, less vulnerable developments and water compatible developments which is applicable to Wales.

7.7 Mitigation Measures Forming Part of the Scheme Design

Embedded mitigation and design

7.7.1 The embedded design and mitigation measures that are relevant to road drainage and the water environment are summarised in this section.

Bridge construction

7.7.2 The proposed bridge will align with the existing bridge piers to reduce disruption to the flow of the River Dee.

7.7.3 Use of jack up barge has removed the need for dredging and therefore will reduce disturbance to the sediments and the riverbed.

Drainage strategy

7.7.4 Drainage capture and conveyance along the proposed highway is proposed to be predominantly via a kerb and gully system[38].

7.7.5 The Scheme drainage east of the River Dee crossing (Garden City) will be conveyed and discharged into the existing swale channel in the southbound verge. The ditch is proposed to be modified by increasing the base width and proposed regrading banks to a 1 in 3 slope to improve the existing flooding issues.

7.7.6 The proposed design provides an additional length of open channel for the Queensferry Drain. Similarly to the existing scheme, flow in the Queensferry Drain open channel will pass through a trash screen and is then culverted through a relocated NRW pumping station before being pumped via a new replacement outfall into the River Dee.

7.7.7 It is assumed a non-return flap valve will be installed on the new Queensferry Drain outfall to prevent tidal ingress upstream to the pumping station. Further consultation will be required with NRW and DCWW at the detailed design stage.

Confirmation of ground conditions

7.7.8 Prior to construction, an investigation of underlying deposits particularly where proposed infrastructure will be located. This information will be used to support embedded mitigation to ensure environmental constraints and to inform detailed design.

Good practice

7.7.9 The following measures constitute best practice and are control measures which are expected to be integrated into the construction phase. Pollution prevention and mitigation measures are incorporated in the Outline CEMP[8] to ensure that good working practices are followed to manage environmental risks. The Outline CEMP includes standard good practice guidance set out in the guidance outlined below:

a) CIRIA Culvert Design and Operation Guide (C689)[52]

b) CIRIA Culvert, screen and outfall manual (C786)[53]

c) The SUDS Manual (C753)[54]

d) CIRIA: Control of water pollution from construction sites: Guidance for consultants and contractors (C532)[55]

e) BS6031: Code of Practice for earthworks[56]

f) Fish Pass Manual[57]

g) Relevant Guidance for Pollution Prevention (GPP):

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[52] CIRIA (2010) Culvert design and operation guide (C689F). Accessible from: CIRIA (2010) Culvert design and operation guide (C689F) . Accessed January 2025.
[53] CIRIA (2019) Culvert, screen and outfall manual (C786). Accessible from: CIRIA (2019) Culvert, screen and outfall manual (C786) Accessed March 2025.
[54] CIRIA (2015) The SUDS Manual (C753) . Accessible from: CIRIA (2015) The SUDS Manual (C753) Accessed December 2024.
[55] CIRIA (2001) Control of water pollution from construction sites. Guidance for consultants and contractors (C532) . Accessible from: CIRIA (2001) Control of water pollution from construction sites. Guidance for consultants and contractors (C532) Accessed January 2025.
[56] British Standards Institution (2009) Code of practice for earthworks BS 6031:2009 . Accessible from: British Standards Institution (2009) Code of practice for earthworks BS 6031:2009 (accessed December 2024).
[57] Institute of Fisheries Management (2020). Fish Pass Manual: Guidance Notes On The Legislation, Selection and Approval Of Fish Passes In England And Wales. Available online at: FISH PASSES. Accessed January 2025.

i) GPP 1: Understanding your environmental responsibilities - good environmental practices[58]

ii) GPP 4: Treatment and disposal of wastewater when there is no connection to the public foul sewer[59]

iii) GPP 5: Works and maintenance in or near water[60]

iv) GPP 6: Working at construction and demolition sites[61]

v) GPP 21: Pollution incident response planning[62]

vi) GPP 22: Dealing with spills[63]

vii) GPP 26: Safe storage – drums and intermediate bulk containers[64]

7.7.10 A detailed CEMP will be completed by the appointed principal contractor during pre-construction phase. This will include the process and procedure for responding and reporting environmental incidents after being agreed with NRW.

7.8 Assessment of construction potential effects

7.8.1 During construction, the Scheme has the potential to directly affect road drainage and the water environment for a temporary duration. The construction activities are provided in Chapter 2: The Project of this Environmental Statement. In summary, the construction programme for the main works is expected to be approximately 2-3 years, with in-river piling work taking up to 12 months. These dates are subject to the contractor's detailed construction methodology, sequencing and programme. The expected start date (subject to approval) will be Spring 2027; however, some activities will extend beyond the completion data, such as demolition of work compounds and seasonally constrained activities like landscaping or enhancements.

[58] Scottish Environment Protection Agency (2021) Guidance for Pollution Prevention. Understanding your environmental responsibilities- good environmental practices GPP1. Version 1.2 Accessible from: guidance-for-pollution-prevention-1-2022-update.pdf Accessed December 2024.
[59] Scottish Environment Protection Agency (2021b) Guidance for Pollution Prevention. Treatment and disposal of wastewater where there is no connection to the public foul sewer . Accessible from: guidance-for-pollution-prevention-4-2022-update.pdf Accessed November 2024.
[60] Scottish Environment Protection Agency (2018) Guidance for Pollution Prevention. Works and maintenance in or near water GPP5. Version 1.2 Accessible from: gpp-5-works-and-maintenance-in-or-near-water.pdf Accessed November 2024.
[61] Scottish Environment Protection Agency (2023b) Guidance for Pollution Prevention: Working at construction and demolition sites: GPP 6. Version 1 . Accessible from: gpp6-working-on-construction-and-demolition-sites.pdf
[62] Scottish Environment Protection Agency (2021c) Guidance for Pollution Prevention. Pollution incident response planning: GPP 21. Version 1.1 (accessed December 2024), accessible from: gpp-21-final.pdf Accessed November 2024.
[63] Scottish Environment Protection Agency (2018b) Guidance for Pollution Prevention. Dealing with Spills GPP 22. Version 1 . Accessible from: gpp-22-dealing-with-spills.pdf Accessed November 2024.
[64] Scottish Environment Protection Agency (2021d) Guidance for Pollution Prevention. Safe Storage of Drums and Intermediate Bulk Containers (IBCs): GPP26. Version 1.2 . Accessible from: guidance-for-pollution-prevention-26-2022-updated.pdf Accessed November 2024.

7.8.2 The potential effects identified which have the potential to occur during construction are summarised in Table 7.11.

Table 7-11 Summary of construction potential effects

Potential effects	Description
Deterioration of surface water quality	• Disturbance of silt/soil generating surface runoff with high sediment concentrations (mobilised suspended solids). Potential for natural silts within the floodplain to contain metals (including lead) that could be washed downstream. • Accidental spillage of fuels, oils, chemicals and materials (e.g. concrete, plant fuels / oils, lubricants, hydraulic fluids and floating solids such as litter) resulting in pollution of watercourses and potential impacts on fish and downstream ecological designated features. • Discharge of water with high suspended solid concentrations and / or contaminants (particularly from concrete pouring) due to a flood event overwhelming the Scheme. • Dewatering of excavations and discharge of high suspended solid content to receiving watercourses.
Disruption to groundwater flow	• Localised reduction in groundwater level associated with potential dewatering activity in excavations. • Disturbance of the ground from piling could lead to disruption of groundwater flows.
Deterioration of groundwater quality	• Risk that piling works will introduce pollution pathways and allow infiltration of contaminated water/runoff to an aquifer. • Disturbance of the ground from piling could lead to increased turbidity in groundwater.
Changes to geomorphological features.	• Obstructions within the channel/floodplain or plant trafficking on riverbanks causing an increased risk of erosion or scouring. • Alteration of geomorphological features through plant trafficking, excavation, and alteration of the Queensferry Drain.

Deterioration of surface water quality

7.8.3 Both sedimentation and chemical pollution could have an adverse impact on designated features through deterioration of water quality in the absence of suitable mitigation measures.

7.8.4 Dewatering of excavations could result in the discharge of water with a high suspended solid content to receiving watercourses. The Queensferry Drain has a small baseflow of 0.002m^3/s and therefore has a lower potential than the River Dee to dilution impacts from discharge with high suspended solid concentrations.

The River Dee has sensitive features which could be adversely affected by increased sediment loads.

7.8.5 Disturbance of silt/soil generating surface runoff with high sediment concentrations (mobilised suspended solids) may occur. There is potential for natural silts within the floodplain to contain contaminants (including lead) that could be washed downstream.

7.8.6 In-channel and bank works, including bridge pier construction, earthworks, and the realignment of Queensferry Drain, may disturb sediments, increasing suspended sediment levels and potentially causing temporary sediment plumes that degrade water quality.

7.8.7 Construction activities, including jack-up barge use and piling, carry a risk of accidental spills of fuels, oils, chemicals, and materials during transport to and from the barge. Discharge of water with high suspended solid concentrations and / or contaminants (particularly from concrete pouring) due to a flood event has the potential to pollute the watercourses and cause physical harm to designated ecological features.

7.8.8 The installation of sheet piles and steel tubes may disturb riverbank sediments or release contaminants if not carefully managed. Demolition of the existing bridge could cause loose materials to enter the river below.

7.8.9 The diversion of the Queensferry Drain and construction of new structures (outfall and pumping station) and in-channel works in the River Dee creates a risk of rapid mobilisation of chemical pollution entering watercourses.

Embedded design and mitigation measures

7.8.10 Embedded mitigation measures incorporated into the Scheme design are detailed in Section 7.7. Water sampling was carried out to ascertain the baseline characteristics of suspended solids and pollutant concentrations which may be increased as a result of the Scheme. Sampling indicated that some parameters have an elevated baseline concentration above EQS thresholds or are highly

variable. To prevent increased loading of contaminants during construction mitigation is required.

7.8.11 Measures to control pollution during construction will be set out in the Outline CEMP[8] to prevent deterioration of surface water quality. These will include:

a) Controlling runoff during the construction phase through provision of suitable drainage including incorporation of Sustainable Drainage Systems (SuDS) will assist in managing sediment loads.

b) An onsite flood risk management plan will be created and adhered to, containing information around the safe siting of welfare facilities and storage areas for plant during the duration of construction and to prevent materials being mobilised by floodwaters. This plan will also include a flood forecasting strategy to inform the day-to-day planning of works.

c) All pumped drainage from the construction works, including areas used for temporary storage of construction materials or excavated soils, will be passed through silt settlement treatment prior to discharge to surface watercourses, drains or sewers.

d) Barge movements will be carried out at high tide to avoid the need for bed ploughing minimising disturbance to sediment.

e) Temporary piles for the construction of the temporary pier are planned to be installed from the bank during low tide to reduce the potential for sediment mobilisation.

f) Using plant nappies around refuelling areas.

g) Steel casing tubes will be installed into the riverbed to seal boreholes, thereby limiting water ingress and containing disturbed sediments.

h) Displaced drilling fluids, such as polymer or bentonite, will be pumped off and recycled to reduce the risk of contamination.

i) During demolition, crash decks will be installed beneath the existing bridge to capture debris and prevent it from entering the river.

j) To reduce sediment loads being discharged from dewatering activities, excavations requiring dewatering and stockpiles should be appropriately managed. Should dewatering be required during construction, sediment laden wastewater will be appropriately disposed of in line with the relevant permits and consents and not left as standing water in excavations.

k) The construction team will be trained in pollution response and spill kits will be distributed throughout the Scheme and within all plant and vehicles.

l) Concrete mixing and washing areas should be contained and sited a minimum of 10m distance from any drainage channels[60]60. Concrete for the bridge

piers will be prepared on land and delivered for the construction of the piers via by a watertight tremie pipe.

7.8.12 The significance of construction activities on deterioration of surface water quality are outlined in Table 7-12 .

Table 7-12 Assessment of significance of effects during construction phase – deterioration of surface water quality

Receptor	Sensitivity	Magnitude	Assessment of significance
River Dee (tidal reach) including designated sites (SSSI, SAC)	Very High	Negligible Limited spatial and temporal extent of the Scheme construction works relative to the overall size of the water body and its attenuation capacity. Provided that good practice measures and embedded mitigation are implemented, any effects are expected to be short-term and highly localised.	Slight (adverse) temporary effect. Not significant.
Queensferry Drain	Medium	Negligible. With the implementation of good construction practices and embedded mitigation measures, any resulting impacts are expected to be short-term, localised, and limited to the construction phase.	Slight (adverse) temporary effect. Not significant.

Receptor	Sensitivity	Magnitude	Assessment of significance
Garden City Drain West	High	Negligible. Construction activities are planned within the wider catchment area, including the development of a new vegetated swale; however, no in-channel works are proposed within the water body itself. While there is a potential risk of uncontrolled runoff mobilising sediment and pollutants, adherence to good practice measures and embedded mitigation will ensure that any impacts remain short-term, localised, and confined to the construction phase.	Slight (adverse) temporary effect. Not significant.

7.8.13 Across all identified surface water receptors, the proposed construction activities are anticipated to result in ***slight adverse (not significant),*** temporary effects. Any potential effects are expected to be short-term and localised and can effectively mitigated through the application of embedded design measures and adherence to standard good practice construction methods.

Disruption to groundwater flow paths

Potential effects

7.8.14 Dewatering may be required, this process can result in a localised reduction in groundwater levels, potentially leading to settlement of surrounding soils, stress or damage to adjacent vegetation, and alterations to groundwater flow paths that could affect water-dependent habitats or nearby surface water features. If prolonged or extensive, dewatering could cause wider drawdown effects.

7.8.15 Disturbance of the ground from piling could lead to disruption of natural groundwater flow paths by enabling water to move more easily between strata or by obstructing existing pathways.

7.8.16 Shallow groundwaters are anticipated to be present underlying the Scheme. Ground and earthworks including compaction from heavy machinery, increased impermeable areas piling and excavations may also cause disruption to the shallow groundwater flow regime and recharge efficiency.

Embedded design and mitigation measures

7.8.17 Embedded mitigation measures incorporated into the scheme design are detailed in Section 7.7.

7.8.18 Standard good practice mitigation measures will be implemented through the Outline CEMP[8] to prevent impacts on groundwater flow. This includes completing excavation and any dewatering as quickly as practicable and minimising ground compaction where possible.

7.8.19 Some excavations may reach shallow groundwater in the form of seepages from higher permeability zones within superficial deposits that are intercepted. Open excavations in some locations may also be more prone to becoming inundated by groundwater. Standard management for temporary dewatering system and discharge to be used during construction.

7.8.20 The significance of construction activities on disruption to groundwater flow are outlined in Table 7-13 .

Table 7-13 Assessment of significance of effects during construction phase – disruption to groundwater flow paths

Receptor	Sensitivity	Magnitude	Assessment of significance
Dee Carboniferous Coal	High	Negligible	Slight (adverse) temporary effect.

Receptor	Sensitivity	Magnitude	Assessment of significance
Measures groundwater body and DWPA		Superficial deposits of approximately 34m thickness are anticipated to underlay across much of the Scheme area, which may provide some protection to the underlying groundwater body. Due to the limited spatial and temporal extent of the works in relation to the overall groundwater water body and with the implementation of good practice measures and embedded mitigation, any effects are expected to be short-term and localised.	Not significant.
Shallow groundwaters	Low	Negligible Shallow groundwater systems are likely to be present, which are susceptible to dewatering impacts such as drawdown. However, the overall magnitude of construction-related effects remains negligible due to the limited spatial and temporal scope of the works. With the implementation of good practice measures and embedded mitigation, any effects are expected to be short-term and localised.	Slight (adverse) temporary effect. Not significant.

7.8.21 For both groundwater receptors, the proposed construction activities are anticipated to result in ***slight adverse (not significant)***, temporary effects to groundwater flow paths. The impacts are expected to be short-term, localised and effectively mitigated through the application of embedded design measures and adherence to standard good practice construction methods.

Deterioration of groundwater quality

Potential effects

7.8.22 There is a risk that piling works could introduce pollution pathways and allow infiltration of contaminated water/runoff to an aquifer. The presence of shallow groundwater increases the vulnerability to potential impacts from nearby construction activities due to their proximity to the surface.

7.8.23 Piling through riverbed silt and glacial till could create pathways for surface contaminants to reach groundwater. If piling works are not managed properly, there is a risk that drilling fluids could contaminate nearby surrounding soil and water bodies. The formation of new preferential pathways could lead to saline intrusion.

7.8.24 Disturbance of the ground from piling could lead to increased turbidity in groundwater. Drilling activities may disturb sediments and disrupt soil stratification, potentially allowing fine particles to migrate into underlying aquifers. Increased turbidity can facilitate the transport of contaminants through adsorption, further effecting groundwater quality. Additionally, elevated turbidity may clog pore spaces reducing permeability and the aquifer's natural filtration and recharge capacity.

Embedded design and mitigation measures

7.8.25 Embedded mitigation measures incorporated into the scheme design are detailed in Section 7.7.

7.8.26 Standard good practice mitigation measures will be implemented through the Outline CEMP[8] to prevent impacts on groundwater quality. This includes appropriate management of excavations and stockpiles. Should dewatering be required during construction, sediment laden wastewater will be appropriately disposed of in line with the relevant permits and consents and not left as standing water in excavations.

7.8.27 Steel casing tubes will be installed into the riverbed to seal boreholes, thereby limiting water ingress to the groundwater body containing disturbed sediments.

7.8.28 The significance of construction activities on deterioration of groundwater quality are outlined in Table 7-14 .

Table 7-14 Assessment of significance of effects during construction phase – deterioration of groundwater quality

Receptor	Sensitivity	Magnitude	Assessment of significance
Dee Carboniferous Coal Measures groundwater body	High	Negligible Vertical movement of the groundwater is anticipated to be impeded by impermeable clay layers that are interbedded with granular material. Construction activities such as piling have the potential to introduce contaminants and establish new pollution pathways, however, the overall impact is assessed as negligible due to the limited spatial and temporal extent of the works in relation to the overall water body. With the implementation of best practice measures and embedded mitigation, any effects are expected to be short-term and localised.	Slight (adverse) temporary effect. Not significant.

Receptor	Sensitivity	Magnitude	Assessment of significance
Shallow groundwaters	Low	Negligible Shallow groundwaters are more susceptible to contamination due to the increased likelihood of pathway formation from its proximity to construction activities. However, the overall magnitude of construction-related effects remains negligible due to the limited spatial and temporal scope of the works. With the implementation of good practice measures and embedded mitigation, any effects are expected to be short-term and localised.	Slight (adverse) temporary effect. Not significant.

7.8.29 For the groundwater receptors, the proposed construction activities are anticipated to result in ***slight adverse (not significant)***, temporary effects on groundwater quality. The impacts are expected to be short-term, localised and effectively mitigated through the application of embedded design measures and adherence to best practice construction methods.

Changes to geomorphological conditions

Potential effects

7.8.30 Obstructions within the channel/floodplain or plant trafficking on riverbanks may result in an increased risk of erosion or scouring occurring.

7.8.31 In-channel works including piling for installation of the new bridge piers and temporary structures will alter river flows and will result in localised permanent disturbance to the bed morphology and silt and potentially impacting localised flow

velocities and causing scouring. These temporary structures may also disrupt natural sediment transport processes and there is a risk of sediment plumes occurring.

7.8.32 Excavation and temporary sheet piling for abutment installation on both banks, including intertidal and shoreline areas, are likely to disturb bank morphology. The use of temporary platforms and associated piles will further contribute to this disturbance. Additionally, the installation of temporary piers and access platforms will require clearance of riparian and bank vegetation, reducing bank stability and increasing susceptibility to erosion and failure. Soil disturbance and compaction from construction activities may also elevate surface runoff and sediment input to the watercourse.

7.8.33 The diversion and reconfiguration of the Queensferry Drain, including the introduction of new open channel sections, may alter the natural flow regime, leading to changes in erosion and deposition patterns.

7.8.34 Excavation and construction near watercourses may disrupt sediment balance, increase sediment input or localised scouring, and reduce bank stability through vegetation removal. Soil compaction from material storage and construction activities may further elevate surface runoff and erosion, contributing additional sediment to the river system.

7.8.35 Further detail on assessment of hydromorphological supporting conditions for the River Dee is included in the WFD Assessment[2].

Embedded design and mitigation measures

7.8.36 Embedded mitigation measures incorporated into the scheme design are detailed in Section 7.7.

7.8.37 Standard good practice mitigation measures will be implemented through the Outline CEMP[8] to prevent impacts occurring to geomorphological conditions. This includes the following:

a) The new bridge will be constructed offline, allowing the majority of works to proceed without interfering with the river flow and aquatic sensitive features.

b) Barge movements will be carried out at high tide to avoid the need for bed ploughing minimising disturbance to sediment.

c) Temporary piling for the temporary platform is proposed to be installed from the bank during low tide conditions to minimise silt disturbance.

d) Temporary sheet piling is anticipated during installation of the abutments to separate the construction works from the watercourse and prevent sediment entering the watercourse.

e) The creation of new reaches of open channel in the Queensferry Drain (approximately 288 m length) replacing the existing culverted reaches is anticipated to deliver a positive geomorphological benefit by replacing previously culverted sections of the watercourse, enhancing natural flow connectivity and habitat potential.

f) Pile casing installation will be limited to the hours of 08:00–17:00 and will not occur within three hours of high tide at Chester Weir, in order to minimise disturbance to migratory fish.

g) Piling activities will be carried out in line with a piling risk assessment to minimise disturbance to the water body's hydromorphological supporting conditions.

h) Where possible, like for like or improved habitat will be reinstated following construction to support morphological conditions.

7.8.38 The significance of construction activities on deterioration of geomorphological conditions are outlined in Table 7-15 .

Table 7-15 Assessment of significance of effects during construction phase – changes to geomorphological conditions

Receptor	Sensitivity	Magnitude	Assessment of significance
River Dee (tidal reach) Designated sites (SSSI, SAC)	Very High	Negligible Although construction activities will elevate the risk of erosion and alter flow regimes due to in-channel works, bank modifications, and floodplain interventions, the overall impact is assessed as negligible. This is due to the limited spatial and temporal extent of the works relative to the overall size of the water body. Provided that good practice measures and embedded mitigation are implemented, any effects are expected to be short-term and localised.	Slight (adverse) temporary effect. Not significant.
Queensferry Drain	Medium	Negligible. The diversion and reconfiguration of Queensferry Drain will affect local morphology; however, not all impacts are negative. Replacing previously culverted sections with new open channels will enhance natural flow dynamics and improve habitat potential. While construction activities such as excavation may temporarily disrupt sediment balance and alter erosion and deposition patterns, these effects are localised and short-term. As a result, the overall impact is assessed as negligible. Provided that good practice measures and embedded mitigation are implemented, any	Slight (adverse) temporary effect. Not significant.

Receptor	Sensitivity	Magnitude	Assessment of significance
		effects are expected to be short-term and localised.	
Garden City Drain West/ Manor Drain	High	Negligible. Although construction activities may increase the risk of erosion and potentially alter flow patterns within the catchment, the overall impact is considered negligible. As no direct in-channel or bank works are planned for Garden City Drain West, any effects are expected to be minimal in relation to the overall scale of the water body. Provided that good practice measures and embedded mitigation are implemented, any effects are expected to be short-term and localised.	Slight (adverse) temporary effect. Not significant.

7.8.39 Across the receptors, the proposed construction activities are anticipated to result in ***slight adverse (not significant)***, temporary effects. The impacts are expected to be short-term, localised and effectively mitigated through the application of embedded design measures and adherence to best practice construction methods.

7.9 Assessment of operational potential effects

7.9.1 The following activities associated with the operational phase of the Scheme that may have the potential to affect road drainage and the water environment are summarised in Table 7.16 and detailed in the following sections.

Table 7-16 Summary of operational potential effects

Potential effects	Description
Hydromorphological changes and riparian habitat disturbance	• Changes to hydromorphology/habitat from realignment of Queensferry drain. • Changes to hydromorphology from the new outfall to the River Dee. • Installation of a new bridge crossing could lead to localised changes in bank stability and potential for disturbance of in-channel morphological features, as well as localised permanent riparian vegetation. Creation of new bridge crossing could result in a disconnect in the floodplain resulting in loss of floodplain habitat. • Removal of vegetation during bank works may result in a higher risk of bank erosion or bank failure over the medium term, although this would reduce as the landscape design matures.
Changes to physical processes in the River Dee	• Changes to flow, velocity or sediment dynamics within the River Dee as a result of additional piers.
Disturbance to saltmarsh habitat	• Direct loss of saltmarsh habitat on river banks.
Changes to groundwater quantity	• Piling and permanent dewatering may cause a change in the groundwater flow regime which may result in interruption of flow, leading either to reduction or loss of water supply to the watercourses, and potential loss of habitat (which may be permanent).
Changes to groundwater quality	• New drainage systems may reduce recharge to the underlying aquifer, thereby interrupting flow, leading to a reduction or loss of water supply to abstractions, springs, streams, and wetland, and potential loss of aquatic habitat (which may be permanent).
Deterioration of surface water quality	• Discharges from new drainage outfalls could result in degradation of water quality. • Discharge of routine run-off may cause a long-term degradation of water quality and changes to flow and velocity in the receiving watercourses.
Changes in flood risk	• Changes in surface water flow pathways may result in increased flood risk.

Hydromorphological changes and riparian habitat disturbance

Changes to hydromorphology/habitat from realignment of the Queensferry drain.

7.9.2 The proposed embedded design is considered to be ecologically sensitive and promotes a natural hydromorphological regime through creation of a reach of new length of open channel either side of the North Wales Coast Railway line on the Queensferry Drain. Realignment will create approximately 288 m length of open channel which was previously culverted, which will have a positive impact on hydromorphological conditions as well as providing additional water quality and biodiversity benefits.

7.9.3 The channel geometry of the new Queensferry Drain will be agreed with NRW to meet maintenance requirements and allow for sufficient channel capacity. The design will incorporate a stable gradient for side slopes which will be protected from erosion using a vegetated channel, in combination with engineered revetment where necessary. Recommendations for discussion at detailed design include the incorporation of a two-stage channel and riparian enhancement.

7.9.4 The significance of operational activities associated with the realignment of the Queensferry Drain and on hydromorphology and habitat are outlined in Table 7.17.

Table 7-17 Assessment of significance of effects during operational phase - Changes to hydromorphology/habitat from realignment of the Queensferry Drain.

Receptor	Sensitivity	Magnitude	Significance
Queensferry Drain	Medium	Minor beneficial Embedded Scheme design incorporates improvements to the existing culverted channel through creation of reaches of open channel.	Slight beneficial (permanent) effect. Not significant.

7.9.5 The proposed operational activities are anticipated to result in ***slight beneficial (not significant),*** permanent effect on the assessed receptor.

Changes in bank stability and potential for disturbance of in-channel morphological features and riparian vegetation in the River Dee.

7.9.6 Operation of a new permanent bridge crossing could lead to localised changes in bank stability and potential for disturbance of in-channel morphological features, as well as localised permanent riparian vegetation.

7.9.7 There is potential for riverbed primary and secondary scour to occur around the new bridge supports.

7.9.8 Embedded design has been undertaken in line with DMRB CD351 –The design and appearance of highways structures[56] guidance as well as CIRIA C742[57] guidance on scour at bridges and other hydraulic structures.

7.9.9 The new piers and alignment are consistent with the existing bridge structure to minimise disruption to flows. Abutments will be set back from the bank which will minimise the impact on the bank morphology through embedded design.

7.9.10 Bathymetric surveys[36] (2021–2022) confirm the dynamic nature of the watercourse. Scour protection has not been included in the design to allow the riverbed to maintain its natural mobility without artificial constraints. Sediment transport modelling indicates that, while the new bridge encourages localised erosion and deposition near the piles, overall sediment dynamics and tidal regimes remain largely unaffected, suggesting minimal disturbance to in-channel morphological features.

7.9.11 As part of the saltmarsh mitigation proposals, the concrete revetment under the existing bridge will be altered through localised excavation and placement of geotextiles, to secure the growing saltmarsh habitat which will also contribute to bank stability in this area.

7.9.12 Table 7.18 outlines the potential impacts of operational activities associated with the new bridge on bank stability, in-channel morphology, riparian vegetation, and overall hydromorphology and habitat.

Table 7-18 Assessment of significance of effects during the operational phase - Changes in bank stability and potential for disturbance of in-channel morphological features and riparian vegetation in the River Dee.

Receptor	Sensitivity	Magnitude	Significance
Dee N. Wales WFD water body; Designated site features (Saltmarsh and sensitive habitat)	Very High	Negligible The new bridge hydrodynamic and sediment modelling results indicate that the Scheme influences localised flow conditions. The broader impact on tidal regime and sediment transport remains limited which indicates that disturbance of in-channel morphological features will likely be highly localised.	Slight (adverse) permanent effect. Not significant.

7.9.13 For the identified receptors, the proposed operational activities are anticipated to result in ***slight adverse (not significant),*** permanent effects. The impacts are expected to be highly localised through the application of embedded design measures.

Changes to hydromorphology of the River Dee as a result of the new outfall

7.9.14 Currently runoff from the west side of the existing A494 bridge drains into the River Dee via the Queensferry Drain outfall which is adjacent to Dŵr Cymru Welsh Water (DCWW) sewage outfall.

7.9.15 Runoff from the west side of the proposed bridge will outfall into the realigned Queensferry Drain, pass through a pumping station and then discharge via a replacement outfall. It is assumed a non-return flap valve will be installed on the new Queensferry Drain outfall to prevent tidal ingress upstream to the pumping

station. The detailed design will adhere is likely to consist of a concrete headwall with scour protection, better access for maintenance and habitat restoration of marine grassland.

7.9.16 The principle of connecting to the Queensferry Drain watercourse, in line with the existing drainage arrangement, has been discussed with NRW. Further details on this will be provided at the detailed design stage and will be agreed with NRW and DCWW.

7.9.17 As the proposed outfall plans consist of a replacement of the existing structures (Queensferry Drain outfall and DCWW outfall) designed with adherence to good practice design principles[53] this is anticipated to result in minimal change from the baseline hydromorphological conditions.

7.9.18 The Queensferry Drain is estimated to have a baseflow of 0.02m3/s which will create a constant discharge. Discharge from the new outfall (maximum rate is 2.275m3/s for 1 in 100 year event plus 40% climate change allowance) will contribute a minimal indiscernible increase to the hydrological flow in the River Dee. The design of the outfall will be confirmed at the detailed design including provision for scour protection if required.

7.9.19 Table 7-19 outlines the potential impacts of operational activities associated with the new bridge on bank stability, in-channel morphology, riparian vegetation, and overall hydromorphology and habitat.

Table 7-19 Assessment of significance of effects during the operational phase - Changes to hydromorphology of the River Dee as a result of the new outfall

Receptor	Sensitivity	Magnitude	Significance
Queensferry Drain	Medium	Negligible The outfall will be confirmed at detailed design stage, however as it is a replacement structure it anticipated to result in minimal change from the baseline hydromorphological conditions.	Slight (permanent) effect. Not significant.
River Dee (tidal reach) including designated sites (SSSI, SAC)	Very High	Negligible The outfall will be confirmed at detailed design stage, however as it is a replacement structure it anticipated to result in minimal change from the baseline hydromorphological conditions.	Neutral (permanent) effect. Not significant.

7.9.20 The proposed operational activities relating to the replacement outfall are anticipated to result in ***slight adverse (not significant)***, permanent effect for the River Dee) and a ***neutral (not significant)*** *permanent* effect for the Queensferry Drain. The impacts are expected to be highly localised through the application of embedded design measures.

Changes to physical processes in the River Dee

7.9.21 Potential effects could occur to flow, velocity or sediment dynamics within the River Dee associated with the operation of the Scheme, including the permanent additional piers.

7.9.22 Embedded design has been undertaken in line with DMRB CD351 –The design and appearance of highways structures[65] guidance as well as CIRIA C742 guidance on scour at bridges and other hydraulic structures[66]. The new piers have been designed to be in alignment with the existing bridge structure to minimise disruption to flows.

7.9.23 The Hydrodynamic and sediment modelling findings reported in Volume 3, Technical Appendix 7E indicate that the operation of the Scheme will not significantly alter water levels but will lead to localised changes in current speeds and flow patterns around the additional permanent piers.

7.9.24 Although localised areas of erosion and deposition occur particularly near the existing and new bridge piles there is no significant disruption of overall sediment dynamics.

7.9.25 The significance of potential effects to flow, velocity or sediment dynamics from operational activities associated with the Scheme are outlined in Table 7-20 .

[65] Highways England et al., 2020. CD 351 The design and appearance of highway structures (formerly BA 41/98). Revision 0.
[66] Ciria, 2024. C742- Manual on scour at bridges and other hydraulic structures. Second Edition.

Table 7-20 Assessment of significance of effects during the operational phase - Changes to physical processes in the River Dee.

Receptor	Sensitivity	Magnitude	Significance
River Dee (tidal reach) including designated sites (SSSI, SAC)	Very High	Negligible The new bridge influences localised flow conditions, however, its broader impact on tidal regime and sediment transport remains limited in comparison to the modelled baseline and highly localised.	Slight adverse (permanent) effect

7.9.26 For the identified receptors (River Dee tidal reach and associated protected areas), the proposed operational activities are anticipated to result in ***slight adverse (not significant)***, permanent effect. The impacts are expected to be highly localised through the application of embedded design measures.

Direct loss of salt marsh habitat on river banks.

7.9.27 The replacement bridge will likely affect an area of saltmarsh by overshadowing leading to possible deterioration of the saltmarsh habitat present. The total area likely to be affected is anticipated to be around 0.015 hectares which represents roughly 0.000095% of the wider SAC that covers a total area of 15,805 hectares.

7.9.28 The north-eastern bank of the river beneath the existing bridge is a concrete revetment currently devoid of any vegetation. This will be either removed or adapted to encourage a growing medium to form and encourage natural recolonisation of plants from the adjacent riverbank. Localised excavation or formation of pockets by mechanical coring will be required with the use of geotextiles to secure the growing medium to prevent washout during periods of high spring tides.

7.9.29 The significance of direct loss of salt marsh habitat on river banks from operational activities associated with the Scheme are outlined in Table 7-21 . Saltmarsh habitat disturbance and loss has also been considered in EIA Chapter 8:

Terrestrial Biodiversity, Chapter 16: Marine Environment and Technical Appendix 7.B WFD Assessment[2].

Table 7-21 Assessment of significance of effects during the operational phase - Direct loss of salt marsh habitat on river banks.

Receptor	Sensitivity	Magnitude	Significance
Dee N. Wales WFD water body, Designated site features including sensitive saltmarsh habitat	Very High	Minor adverse Adverse permanent loss of saltmarsh habitat is highly localised and mitigation measures including natural colonisation is anticipated to occur over a long timescale (>5 years).	Moderate (adverse) permanent effect. Significant.

7.9.30 For the identified receptors, the proposed operational activities are anticipated to result in ***moderate adverse, permanent effects***. As a result of the long timescale (>5 years) anticipated for natural colonisation to occur the impacts will not be effectively mitigated through the application of embedded design measures and additional mitigation is required. Additional mitigation is detailed in Section 8.

Changes to groundwater quantity

7.9.31 Subsurface structures and deep foundations which are part of the permanent design (e.g., permanent piles) may cause a barrier to groundwater flow. The deep foundations for the piles could also create a permanent vertical flow pathway into the groundwater body which could result in rapid transport of pollutants.

7.9.32 Previous ground investigations which reached a depth of 30m bgl have not encountered the boundary between the overlying superficial deposits and the Coal Measures. Piles are anticipated to be driven to a depth of approximately 34m below the river bed level. Under a precautionary approach there is a possibility of striking the groundwater aquifer.

7.9.33 As part of the embedded design the permanent piles will be capped upon completion of construction which will reduce the risk of enabling preferential pathways for contaminants.

7.9.34 The significance of potential effects on groundwater quantity from operational activities associated with the Scheme are outlined in Table 7-22 .

Table 7-22 Assessment of significance of effects during the operational phase – changes to groundwater quantity.

Receptor	Sensitivity	Magnitude	Significance
Dee Carboniferous Coal Measures WFD groundwater body	Very High	Negligible Operational effects are anticipated to be highly localised	Slight (adverse) permanent effect. Not significant.
Shallow groundwater (secondary undifferentiated)	Medium	Negligible Any operational effects are anticipated to be highly localised	Slight (adverse) permanent effect. Not significant.

7.9.35 For the identified receptors, the proposed operational activities are anticipated to result in ***slight adverse (not significant),*** permanent effects on groundwater quantity. The impacts are expected to be highly localised and not significant.

Changes to groundwater quality

7.9.36 Runoff from highways may contain suspended sediments, hydrocarbons, metals and de-icing fluids which can have adverse impacts upon groundwater quality if the contaminants reach the underlying aquifers. Contaminants such as poly aromatic hydrocarbons (PAHs) may persist longer term as they are resistant to degradation and for the purpose of this assessment are considered to result in permanent effects.

7.9.37 Groundwater is expected to move horizontally through permeable sand and gravel layers, while vertical movement is restricted by interbedded clay. The underlying mudstone bedrock is likely impermeable, reducing the risk of pollutant migration to the aquifer at approximately 34 m depth. However, faulting in the area may provide pathways for groundwater flow.

7.9.38 Groundwater assessments were undertaken as part of the HEWRAT assessment for the proposed outfalls on the Queensferry Drain and Garden City Swale due to the presence of low flows (<0.001 m3/s) within the watercourses. The groundwater assessments indicate that all outfalls present a medium risk to groundwater. However, a precautionary approach was taken due to the absence of data and the actual risk is likely to be much lower.

7.9.39 The significance of potential effects on groundwater quality from operational activities associated with the Scheme are outlined in Table 7-23 .

Table 7-23 Assessment of significance of effects during the operational phase – changes to groundwater quality.

Receptor	Sensitivity	Magnitude	Significance
Dee Carboniferous Coal Measures WFD groundwater body	Very High	Negligible The bedrock is overlain by impermeable clay layers that are interbedded approximately 34m depth below ground level at the Scheme location and therefore unlikely to be affected.	Slight (adverse) permanent effect. Not significant.
Shallow groundwater (secondary undifferentiated)	Medium	Negligible Soakaway assessment concluded low risk to shallow underlying aquifers from contaminated runoff.	Slight (adverse) permanent effect. Not significant.

7.9.40 For the identified receptors, the proposed construction activities are anticipated to result in ***slight adverse (not significant),*** permanent effects on groundwater quality. The impacts are expected to be highly localised and minimised through the application of embedded design measures.

Deterioration of surface water quality

7.9.41 Discharge of routine highways run-off during operation could cause a deterioration in water quality through increasing pollutant concentrations where insufficient treatment is in place. In addition, there is potential for surface water run-off to be contaminated by accidental spills and mobilisation of de-icing salt and sediment which can result in a temporary impact or longer-term deterioration of water quality.

7.9.42 The 6 months of baseline monitoring and analysis is detailed in the River Dee Surface Water Quality Baseline Report[1]. The analysis suite was designed to help establish the baseline of parameters which may be a risk of increasing in concentration due to the operation of the Scheme.

7.9.43 The HEWRAT tool was used to assess the impact of highway runoff on freshwater bodies (Queensferry Drain and Garden City Drain), with results informing potential effects on the River Dee, as both drains discharge into it. To mitigate adverse impacts, appropriate treatment and containment measures have been integrated into the outline drainage design. The spillage risk assessment findings indicate that for the outfalls assessed no mitigation is required.

7.9.44 Further information on the results can be found in the HEWRAT Assessment[3].

7.9.45 As mitigation, swale and penstocks are proposed for the Queensferry Drain, these will help provide pollution control. These mitigation measures were not included in the HEWRAT assessment as they will be located downstream of the assessment point within the tidally influenced area. The implementation of the swale and penstocks will provide additional mitigation and reduce risk from runoff, providing benefits to water quality in the River Dee.

7.9.46 On the northern side of the A494, gullies will discharge directly into a vegetated highway drainage swale. This swale flows westward before reconnecting with the proposed drainage network and discharging to the realigned vegetated Queensferry Drain. The swale length has been maximised where space allows to enhance water treatment, biodiversity, and amenity value. The existing Garden City swale north east of the River Dee, which discharges to Manor Drain slopes, will be realigned and vegetated to provide filtering. This should provide 80% sediment removal efficiency and no additional mitigation measures or improvements are proposed.

7.9.47 The significance of potential effects of deterioration of surface water quality from operational activities associated with the Scheme are outlined in Table 7-24 .

Table 7-24 Assessment of significance of effects during the operational phase – deterioration of surface water quality.

Receptor	Sensitivity	Magnitude	Significance
Dee N. Wales WFD; Designated features	Very High	Negligible All runoff from the Scheme will pass through sufficient treatment via Queensferry Drain or Garden City/ Manor Drain prior to discharging to the River Dee.	Slight (beneficial) permanent effect. Not significant

Receptor	Sensitivity	Magnitude	Significance
Queensferry Drain	Medium	Minor (beneficial) Currently runoff from the existing road discharges to Queensferry Drain with no attenuation or treatment. The proposed drainage design includes a new swale channel and vegetation lined open channel diversion of the Queensferry Drain which provides treatment for runoff. These mitigation measures will reduce risk from runoff, providing benefits to water quality in the River Dee.	Slight (beneficial) permanent effect. Not significant.
Garden City/ Manor Drain	High	Negligible Currently runoff from the existing road discharges to Garden City/ Manor drain via a vegetated swale. The Scheme will maintain the current drainage regime and the existing swale capacity will be increased. This will continue to provide attenuation treatment (filtration and absorption).	Slight (beneficial) permanent effect. Not significant

7.9.48 Across the identified receptors, the proposed operation of the scheme is anticipated to result in ***slight beneficial (not significant),*** permanent effects.

Flood risk impacts during operation

7.9.49 The risk of flooding could be impacted (increase or decrease) as a result of the operation of the Scheme. Detailed assessment of flood risk is provided in the FCA[4]. To inform the FCA, site-specific hydraulic models for the River Dee[6] and

Queensferry Drain[7] have been developed and used for the detailed assessment of fluvial and tidal flooding consequences.

7.9.50 The predominant sources of flood risk for the scheme are from tidal and fluvial sources; namely the River Dee (tidal and fluvial), and Queensferry Drain (fluvial). The Scheme benefits from existing flood defences alongside the River Dee which will be incorporated in the design as part of the operational Scheme.

7.9.51 For the River Dee (fluvial) the operation of the Scheme may increase water levels in existing river channels. Upstream of the Scheme there will be localised water levels changes inside the channel and no changes to receptor flood risk. The FCA model results also indicate changes in flood risk in areas around Chester Racecourse and the Wepre Drain. However, and as accepted by NRW, there is low confidence in the results for these areas, and further work will be undertaken during the next stage of design development to consider impacts and mitigation if required.

7.9.52 For the River Dee (tidal) the operation of the Scheme may reduce flood risk in a large area adjacent to the Scheme. In some cases, the decrease in water level is expected to be more than 0.3 m. However, and relating to this extreme scenario (0.1% AEP in 2100) only, the FCA modelling also indicates there are some localised areas where both flood depth and extents may increase. On the right banks, flood depths could increase by up to 6 mm in residential areas of Garden City, up to 10 mm in open space (pastoral agricultural) areas of the Northern Gateway Development and up to 2 mm in proposed commercial areas of the Northern Gateway Development. On the left bank in commercial and open space (pastoral agricultural) areas in Queensferry, flood depths could increase by up to 2 mm.

7.9.53 For Queensferry Drain (fluvial), the expected overall trend is for the operation of the Scheme to reduce flood depths across the catchment. In some cases, for example commercial areas near the Scheme, a reduction of up to around 0.092m (92mm) could occur. When comparing water level with and without blockage during the 1% AEP (2100) fluvial event, there is an increase in water levels of up

to 0.07 m within an area of open space (pastoral agricultural) in the Sandycroft area.

7.9.54 NMWTRA receives flood warnings and alerts from NRW. These alerts are issued for the general area and are not site-specific to the A494. In the event of a warning of risk of flooding affecting the A494, a multi-agency Tactical / Strategic Coordination Group meeting would likely be convened to assess and respond to the situation.

7.9.55 Whilst there is no dedicated Flood Emergency Plan in place, there is a local contingency plan, which outlines procedures for westbound, eastbound, and full closures in both directions. This will be reviewed and updated once the new road and bridge are operational.

7.9.56 The Queensferry Drain pumping station will also be designed to be flood-resilient; with electrics and control kiosks located above floodwater levels to ensure that they remain operational and maintainable during times of flooding. The design incorporates new sections of open channel and along with two trash screens which will reduce the probability of debris blockages that may cause flood risk.

7.9.57 The discharge of routine run-off from operation of the Scheme could cause a change to flows and velocity in the receiving watercourses and changes in surface water flood flow pathways could result in increased flood risk as a result of the operation of the Scheme, particularly in Queensferry Drain.

7.9.58 The road drainage alterations will provide adequate drainage to accommodate potential changes in surface run-off, including an allowance for climate change in accordance with DMRB CG 501 - Design of highway drainage systems[67], and through consultation with NRW and the Lead Local Flood Authority. Conclusions from the FCA[4] indicate that the proposed surface water drainage strategy has been developed into an appropriately detailed SuDS drainage design, based upon the constraints of the Scheme, and there is no change in flood risk elsewhere. Section 7 of TAN15[26] has therefore been satisfied.

[67] National highways et al., 2020. CG 501 Design of highway drainage systems (formerly HD 33/16, TA 80/00) Version 2.1.0.

7.9.59 The Environmental Permitting (England and Wales) Regulations 2016 require a FRAP is obtained for any works in, over, under or adjacent to Main Rivers. This will be carried out at a later stage.

7.9.60 The significance of potential flood risk effects from operational activities associated with the Scheme are outlined in Table 7-25 below.

Table 7-25 Assessment of significance of effects during the operational phase – change in flood risk.

Flood risk source	Receptor (class)	Sensitivity	Magnitude	Significance
River Dee fluvial	Transport	Medium (less vulnerable)	Overall, no reportable changes to this receptor's flood risk. For the 0.1% Annual Exceedance Probability (1 in 1000 year) overtopping only event in 2100 (with allowances for climate change), increases in peak flood levels for Transport receptors have been identified for areas around Chester Racecourse (10 mm, Negligible) and the Wepre Drain (52 mm, Moderate Adverse). However, and as accepted by NRW, there is low confidence in the model results for these areas, and further model refinement will be undertaken during the next stage of design development to consider impacts and mitigation if required.	Neutral permanent effect **Not significant**
River Dee tidal	Transport	Medium (less vulnerable)	For the 0.1% Annual Exceedance Probability (1 in 1000 year) overtopping only event in 2100 (with allowances for climate	Slight (adverse) permanent effect

Flood risk source	Receptor (class)	Sensitivity	Magnitude	Significance
			change), Negligible increases in peak flood levels in Welsh Road, Garden City (10 mm) and Station Road, Queensferry (4 mm).	**Not significant**
Queensferry Drain fluvial	Transport	Medium (less vulnerable)	For the 0.1% Annual Exceedance Probability (1 in 1000 year) 'free flowing' event in 2100 (with allowances for climate change), the expected overall trend is for Negligible flood depth reductions across the catchment. The scale of benefit to transport receptors is predicted to be within the bounds of – 10 mm.	Neutral permanent effect **Not significant**
River Dee fluvial	Commercial	Medium (less vulnerable)	Overall, no reportable changes to this receptor's flood risk for the 0.1% Annual Exceedance Probability (1 in 1000 year) event in 2100 (with allowances for climate change), Increases in peak flood levels for Commercial Receptors have been identified for areas around Chester Racecourse (11 mm, Minor Adverse) and the Wepre Drain (108 mm, Major Adverse). However, and as accepted by NRW, there is low confidence in the model results for these areas, and further model refinement will be undertaken during the next stage of design development to consider impacts and mitigation if required.	Neutral permanent effect. **Not significant**

Flood risk source	Receptor (class)	Sensitivity	Magnitude	Significance
River Dee tidal	Commercial	Medium (less vulnerable)	For the 0.1% Annual Exceedance Probability (1 in 1000 year) overtopping only event in 2100 (with allowances for climate change), Negligible increases in peak flood levels in proposed Northern Gateway (2 mm) and existing commercial areas of Queensferry (2 mm).	Neutral permanent effect **Not significant**
Queensferry Drain fluvial	Commercial	Medium (less vulnerable)	No change. The expected overall trend is for flood depths to reduce across the catchment as a result of the Scheme in all assessed events up to and including the 0.1% AEP free flowing event in 2100, with allowance for climate change. The degree flood depths reduce varies between different commercial areas; ranging from 0.00 mm (No change) to –150 mm (Moderate Beneficial).	Neutral permanent effect (worse case) **Not Significant** Moderate (beneficial) permanent effect (best case) **Significant**
River Dee fluvial	Residential	Very high (highly vulnerable)	Overall, no reportable changes to this receptor's flood risk for the 0.1% Annual Exceedance Probability (1 in 1000 year) event in 2100 (with allowances for climate change) Increases in peak flood levels for Residential Receptors has been identified for areas around Chester Racecourse (42 mm, Minor Adverse) and the Wepre Drain (27 mm, Minor Adverse). However,	Neutral permanent effect **Not significant**

Flood risk source	Receptor (class)	Sensitivity	Magnitude	Significance
			and as accepted by NRW, there is low confidence in the model results for these areas, and further model refinement will be undertaken during the next stage of design development to consider impacts and mitigation if required.	
River Dee tidal	Residential	Very high (highly vulnerable)	For the 0.1% Annual Exceedance Probability (1 in 1000 year) overtopping only event in 2100 (with allowances for climate change), Negligible increases in peak flood levels in Garden City (6mm).	Slight (adverse) permanent effect **Not significant**
Queensferry Drain fluvial	Residential	Very high (highly vulnerable)	The expected overall trend is for flood depths to reduce across the catchment as a result of the Scheme in all accessed events up to and including the 0.1% AEP in 2100, with allowance for climate change. Flood depths may reduce by 10 mm (Negligible) in Residential areas.	Slight (beneficial) permanent effect **Not significant**
River Dee fluvial	Pastoral Agriculture	Low (water compatible)	Overall, no reportable changes to this receptor's flood risk for the 0.1% Annual Exceedance Probability (1 in 1000 year) event in 2100 (with allowances for climate change), Increases in peak flood levels for Pastoral Agriculture Receptors has been identified in areas around Chester Racecourse (50 mm, Minor Adverse) and the	Neutral permanent effect **Not significant**

Flood risk source	Receptor (class)	Sensitivity	Magnitude	Significance
			Wepre Drain (67 mm, Major Adverse). However, and as accepted by NRW, there is low confidence in the model results for these areas, and further model refinement will be undertaken during the next stage of design development to consider impacts and mitigation if required.	
River Dee tidal	Pastoral Agriculture	Low (water compatible)	For the 0.1% Annual Exceedance Probability (1 in 1000 year) overtopping only event in 2100 (with allowances for climate change), Negligible (10mm) increases in peak flood levels in the proposed Northern Gateway Development and Queensferry (2 mm). In areas adjacent to the Scheme, there are large areas that are expected to be flood-free or reduced flood levels by up to -300 mm (Major Beneficial) with typical values in order of -100 mm (also Major Beneficial). Upstream of the Scheme, flood depths are predicted to be reduced by 10 mm (Negligible).	Neutral permanent effect (worse case) **Not Significant** Major (beneficial) permanent effect (best case) **Significant**
Queensferry Drain fluvial	Pastoral Agriculture	Low (water compatible)	The expected overall trend is for flood depths to reduce across the catchment as a result of the Scheme, in all accessed events up to and including the 0.1% AEP in 2100, with allowance for climate change. The degree flood depths reduce varies	Neutral permanent effect (best case) **Not Significant** Slight (adverse) permanent

Flood risk source	Receptor (class)	Sensitivity	Magnitude	Significance
			between different pastoral areas – ranging from 0 mm (No change) to -70 mm (Moderate Beneficial) in free-flowing scenarios.	effect (worse case) **Not significant**

7.9.61 Overall, under the worst-case scenario, the Scheme results in Neutral, Slight Beneficial or Slight Adverse permanent effects on flood risk, with no significant adverse effects identified. Under a best-case scenario, Major and Moderate beneficial effects were identified for Pastoral Agriculture (River Dee Tidal) and Commercial receptors (Queensferry Drain), respectively. Both these beneficial effects are considered significant. Due to low confidence in the FCA model results for River Dee Fluvial sources in the Chester Racecourse and the Wepre Drain area, further work will be undertaken during the next stage of design development to consider impacts and mitigation for those areas, if required.

7.9.62 Full details of modelled outcomes and limitations are provided in the FCA[4].

7.10 Additional Mitigation and Monitoring

Construction

7.10.40 There are no requirements for additional mitigation and/or monitoring during the construction phase assuming good practice and embedded mitigation detailed in Section 7.7 and Section 7.8 is adhered to.

Operational

7.10.41 A significant operational effect was identified relating to the direct loss of saltmarsh habitat along the riverbanks.

7.10.42 An offsite compensation area of 1.35 hectares has been identified at Greenfield Marsh, located approximately 15 km downstream of the Scheme near Walwen. The selected area contains areas of saltmarsh habitat of variable condition and has patches of rubble left as vestiges from an old tip. The patches of rubble will

be removed and disposed of to encourage the natural colonisation of the habitat. The Welsh Government will collaborate with FCC and NRW to progress with these proposals should the Scheme be consented. More information on the habitat improvement measures proposed at Greenfield Marsh is presented in Volume 1 Chapter 8 Terrestrial Biodiversity.

7.11 Assessment of Cumulative Effects

7.11.40 These are changes to the environment arising from multiple activities on receptors or resources occurring in combination over a period. Both intra- relationships and inter-relationships have been considered in this section.

7.11.41 Existing nearby developments that are built and operational at the time of assessment have been considered as part of the baseline.

Intra-relationships

7.11.42 In identifying and assessing the likely impacts of the Scheme on road drainage and the water environment, the intra-relationships with the environmental impacts identified in other Environmental Statement chapters have been considered. These are:

a) Chapter 6: Geology and Soils – potential effects discussed regarding disturbance of soils, soil compaction, contaminated soils runoff in Section 6.8. The potential effect of these in relation to degradation of water quality in receiving water bodies has been considered in the road drainage and water environment chapter. Several measures have been highlighted within this chapter as being suitable for mitigating the potential effects on receiving water bodies. These include the protection of soil structure and quality, the protection of controlled water from both general site works, and foundation works, and to manage contamination risks. With adherence to the mitigation detailed in Section 7.7 no cumulative effects are anticipated.

b) Chapter 8: Terrestrial Biodiversity- potential effects of riparian and inter tidal habitat loss have been assessed as part of the chapter in Section 8.7. There are close intra-relationships between this and the EIA Chapter 7: road drainage and water environment chapter. No other cumulative effects are anticipated with the mitigation and compensation detailed in the Section 7.8, 7.9 and 7.10 along with embedded good practice guidance (Section 7.7).

c) Chapter 13: Materials and Waste - Contaminated soils (if encountered) have potential to impact the road drainage system which is linked with potential

effects on receiving watercourses. This could affect aquatic species and water quality. Receiving groundwater quality is also at risk from deterioration. With adherence to the mitigation detailed in Section 7.7 no cumulative effects are anticipated.

d) Chapter 15: Climate - An increase in winter precipitation and frequency of extreme rainfall events as a result of climate change may increase risk of contaminants entering the water environment. This could have adverse potential effects on ecological species and habitats and on water quality. This has been considered in Chapter 7: Road drainage and the water environment. To mitigate against adverse potential effects, the Scheme includes a comprehensive flood risk assessment[4] and drainage design[38], which is in line with DMRB guidance[32] and has been modelled and designed with consideration of climate change allowances and use of a Sustainable Drainage System (SuDS) [38]. With this embedded design and mitigation, no cumulative effects are anticipated.

e) Chapter 12: Noise and Vibration – noise and vibration assessments were carried out for this chapter. Chapter 7: Road drainage and water environment and Chapter 16: Marine Environment includes an assessment of the potential effects of noise and vibration on aquatic species and sediment and water quality. The approach for controlling construction noise will be to reduce source levels where possible and sensitive timing of in-river works as detailed in Section 16.7. With adherence to mitigation detailed in Section 16.7, no cumulative effects are anticipated.

f) Chapter 16: Marine Environment – the chapter considers the potential effects on protected designations, areas, and species. Based on these potential effects, avoidance and mitigation measures to prevent, reduce, or offset any adverse effects are described. There are close inter-relationships between this and the road drainage and water environment chapter in relation to water quality and inter-tidal habitats and designated areas and features. With adherence to mitigation detailed in Section 7.7 and 16.7, no cumulative effects are anticipated.

Inter-relationships

7.11.43 The cumulative effect of the Scheme has been considered with other shortlisted plans or projects within a pre-defined geographical area as part of Chapter 17 (Cumulative Effects and Inter-relationships).

Construction cumulative potential effects

7.11.44 Where concurrent construction is not likely to occur with the Scheme and other schemes, cumulative effects are not anticipated. In addition, where other schemes are located at a distance greater than 2km from the Scheme, it is likely that

appropriate mitigation and attenuation process will prevent any cumulative significant effects.

7.11.45 Northern Gateway residential development is within 2km of the Scheme, however it is anticipated construction works will be completed in 2025 cumulative potential construction effects are not anticipated.

7.11.46 Sealand Manor Solar Farm proposed location is immediately adjacent to the Scheme[68]. The solar farm is currently in the early stages of planning and therefore, concurrent construction is not likely, and thus, cumulative potential construction effects are not anticipated. Should the solar farm construction dates be brought forward, it would include consideration of cumulative impacts with the Scheme.

Operational cumulative potential effects

7.11.47 It is assumed that surface water for other schemes including Northern Gateway (residential development) and Sealand Manor Solar Farm will also be managed through detailed surface water Drainage Strategies that will encompass Sustainable Drainage Systems (SuDS) to ensure that there is no increased risk of flooding from surface water. No significant cumulative effects are therefore anticipated within the Dee catchment.

7.11.48 The Scheme was assessed to have a beneficial effect on water quality due to improved drainage treatment and therefore will not contribute to a deterioration in water quality in combination with other Schemes.

7.11.49 Connah's Quay Low Carbon Power (new combined-cycle gas turbine power station) is not anticipated to have any cumulative effects to physical processes with the A494 Scheme as the A494 Scheme only results in highly localised changes in the River Dee. There is potential risk associated with removal of salt marsh and changes to tidal flood risk which in combination with the Scheme could result in a significant effect. However, as the Connah's Quay Low Carbon Power

[68] Renewable Connections, 2025. Sealand Manor Solar Farm and BESS. Available at: Sealand Manor Solar Farm and Battery Energy Storage System | Renewable Connections. Accessed August 2025.

Scheme is in the early stages of planning and there is limited detail available on the scheme design to inform a cumulative assessment at this stage.

7.11.50 The proposed Tidal Lagoon at Mostyn Dock is located 21 km downstream. The Schemes potential effects are unlikely to result in cumulative impacts on physical processes at this distance.

7.12 Summary of Residual Effects

7.12.40 With the implementation of the additional mitigation and monitoring proposed for saltmarsh there are no residual effects anticipated.

7.12.41 Due to the scale of the impacts and limitations and inherent uncertainty associated with flood estimation, this potential effect is not considered to pose an adverse risk to receptors, and no further mitigation is proposed.

7.12.42 There are no other requirements for additional mitigation and/or monitoring during the construction or operation phase and the potential effects reported under Section 7.8 and 7.9 will remain the same.

Llywodraeth Cymru / Welsh Government

A494 RIVER DEE BRIDGE REPLACEMENT SCHEME

Environmental Statement

Volume 1: Technical Assessment Report

Chapter 8: Terrestrial Biodiversity

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8. Terrestrial Biodiversity

8.1 Introduction

8.1.1 This chapter of the Environmental Statement sets out the assessment of significant effects from the Scheme on terrestrial habitats, species and ecosystems. A 'significant effect' is one which either supports or undermines biodiversity conservation objectives for important ecological features[1]. A separate chapter, Chapter 16 Marine Ecology, has been produced which considers the marine ecological features, namely the designations, habitats and species, including Marine Ornithology (specifically waterfowl and waders, including terns and diving birds) within the Scheme and surrounding area. Due to the continuous nature of habitats, it is difficult to draw a precise distinction between marine and terrestrial elements, therefore some overlap between the two chapters will exist.

8.1.2 The Scheme is described in Chapter 2. There are a number of potential effect pathways which are relevant and are considered within this chapter. These include, but are not limited to, the following:

a) Pre-construction activities – ground investigations, vegetation clearance, site preparation.

b) Construction phase – demolition and construction, noise and vibration, habitat loss from land take, pollution incidents and sediment disturbance.

c) Operational phase – wildlife casualties, land use change, change in hydrology, lighting, maintenance, road run-off, alteration to hydrodynamics.

8.1.3 This chapter considers the significant ecological effects of each phase of the Scheme in light of relevant planning policies and legislation. It has been

[1] CIEEM (2018)*Guidelines for Ecological Impact Assessment in the UK and Ireland Terrestrial, Coastal and Marine*. Version 1.3 Chartered Institute of Ecology and Environmental Management, Winchester. Available at https://cieem.net/wp-content/uploads/2018/08/EcIA-Guidelines-v1.3-Sept-2024.pdf [Accessed 21/01/25]

prepared in accordance with the Design Manual for Roads and Bridges (DMRB) LA 108 Biodiversity[2] and LD 118 Biodiversity Design[3].

8.1.4 The ecological baseline has been established through a combination of desk study and field work carried out between 2018 – 2025.

8.1.5 At each stage of the design process the hierarchical principles of 'avoid, mitigate, compensate and enhance' have been assessed as part of the process.

8.1.6 A Habitat Regulations Assessment (HRA) Screening is being carried out in accordance with the provisions of the Conservation of Habitats and Species Regulations 2017 (as amended)[4] and following the guidance of the Design Manual for Roads and Bridges (DMRB) LA115 Habitat Regulations Assessment[5].

8.1.7 The HRA Screening has identified that likely significant effects on qualifying features of the following protected sites could not be ruled out at the Screening stage (Stage 1 of the HRA process), in the absence of appropriate mitigation, taking into consideration their conservation objectives:

a) *River Dee and Bala Lake SAC* – salmon, sea and river lamprey and otter
b) *Dee Estuary SAC* – Atlantic salt meadows, estuaries, mudflats and sandflats not covered by sea water at low tide, and sea and river lamprey
c) *Dee Estuary Ramsar* – Waterfowl and wetland bird assemblage, saltmarsh, intertidal mudflats and sandflats and estuary
d) *Dee Estuary SPA* – Waterfowl and wetland bird assemblage, all features of interest and sub features including saltmarsh, intertidal mudflats and sandflats and estuary.

[2] DMRB LA 108 Biodiversity. Available at https://www.standardsforhighways.co.uk/search/af0517ba-14d2-4a52-aa6d-1b21ba05b465 [Accessed:21/01/25]
[3] DMRB LA 118 Biodiversity Design. Available at https://www.standardsforhighways.co.uk/search/9317652b-4cb8-4aaf-be57-b96d324c8965 [Accessed:21/01/25)
[4] Conservation of Habitats and Species Regulations 2017 (as amended). Available at https://www.legislation.gov.uk/uksi/2017/1012/regulation/1 [Accessed 21/01/245
[5] DMRB (Jan 2020) Sustainability & Environment Appraisal LA115 Habitat Regulations assessment. Available at https://www.standardsforhighways.co.uk/tses/attachments/e2fdab58-d293-4af7-b737-b55e08e045ae?inline=true [Accessed 21/01/25]

8.1.8 It is therefore considered necessary for an Appropriate Assessment (Stage 2) to be carried out for the A494 River Dee Bridge Replacement Scheme on the qualifying features of these protected sites, in line with DMRB LA115. This assessment has been conducted in parallel with this ES and will be reported separately when issued.

8.1.9 Under the same Regulations, it is considered that significant effects on the Deeside and Buckley Newt Sites SAC or its features of interest are unlikely, therefore no further assessment is needed.

8.1.10 The Screening Assessment would be issued to Natural Resources Wales (NRW) for comment.

8.2 Legislation and Policy Framework

National legislation

8.2.1 The following national legislation and national planning policy have been considered in the production of this assessment:

a) The Conservation of Habitats and Species Regulations 2017 (as amended)[6]
b) Wildlife and Countryside Act 1981 (as amended)[7]
c) The Environment (Wales) Act 2016[8]
d) Salmon and Freshwater Fisheries Act 1975[9]
e) The Protection of Badgers Act 1992[10]
f) Well-being of Future Generations (Wales) Act 2015[11]

[6] The Conservation of Habitats and Species Regulations 2017 (as amended). Available at https://www.legislation.gov.uk/uksi/2017/1012/contents/made [Accessed:21/01/25]
[7] Wildlife and Countryside Act 1981 (as amended). Available at (http://www.legislation.gov.uk/ukpga/1981/69) [Accessed:21/01/25]
[8] Environment (Wales) Act 2016. Available at (http://www.legislation.gov.uk/anaw/2016/3/contents) [Accessed:21/01/25]
[9] Salmon and Freshwater Fisheries Act 1975. Available at (https://www.legislation.gov.uk/ukpga/1975/51) [Accessed:21/01/25]
[10] Protection of Badgers Act 1992. Available at (http://www.legislation.gov.uk/ukpga/1992/51/contents) [Accessed:21/01/25]
[11] Well-being of Future Generations (Wales) Act 2015. Available at https://www.gov.wales/well-being-of-future-generations-wales [Accessed:21/01/25]

g) The Invasive Alien Species (Enforcement and Permitting) Order 2019[12]

8.2.2 Section 6 of the Environment Act Wales places a duty on public authorities to seek to maintain and enhance biological diversity (referred to as biodiversity). All public bodies, statutory undertakers, Ministers of the Crown and other public office holders are required to apply the duty when they are carrying on any functions in Wales, or in relation to Wales.

8.2.3 Section 7 of the Act places a duty on the Welsh Ministers to publish, review and revise lists of living organisms and types of habitat in Wales, which they consider are of key significance to sustain and improve biodiversity in relation to Wales.

8.2.4 The Wellbeing of Future Generations (Wales) Act 2015 includes a number of well-being goals (Part 2 Section 4), the second of which is 'A resilient Wales' described as:

'A nation which maintains and enhances a biodiverse natural environment with healthy functioning ecosystems that support social, economic and ecological resilience and the capacity to adapt to change (for example climate change).'

8.2.5 Schedule 3 of the Flood and Water Management Act 2010 makes SuDS a mandatory requirement for all new developments. The legislation ensures resilient drainage systems for new developments in both urban and rural areas. Within the regulations is a specific requirement for biodiversity (Standard S5) which states:

'The design of the surface water management system should maximise biodiversity benefits'

[12] Available at The Invasive Alien Species (Enforcement and Permitting) Order 2019 (legislation.gov.uk) [Accessed:21/01/25)

8.2.6 Standard S5 addresses the design of SuDS development and enriches biodiversity value by linking networks of habitats and ecosystems together.

8.2.7 The Invasive Alien Species (Enforcement and Permitting) Order 2019 came into force on 1st October 2019. This Order allows for the enforcement of Regulation (EU) No. 1143/2014 on the prevention and management of the introduction and spread of invasive alien species in England and Wales including the relevant licences, permits and rules for keeping invasive alien species.

National planning policy

8.2.8 Planning Policy Wales 12 (PPW12)[13] Section 6.4.3 sets out the responsibilities of the Local Planning Authority when assessing development proposals and their impacts on biodiversity. This document states:

'The planning system has a key role to play in helping to reverse the decline in biodiversity and increasing the resilience of ecosystems, at various scales, by ensuring appropriate mechanisms are in place to both protect against loss and to secure enhancement'

8.2.9 PPW 12 sets out the requirement for planning authorities to demonstrate that they have sought to fulfil the duties and requirements of Section 6 of the Environment Act 2016 by taking all reasonable steps to maintain and enhance biodiversity in the exercise of their functions.

8.2.10 Policies relevant to biodiversity included in Planning Policy Wales can be summarised as follows:

a) **Green Infrastructure:** to include the submission of proportionate green infrastructure statements with planning applications and signposting Building with Nature standards.

b) **Net Benefit for Biodiversity and the Stepwise Approach:** The stepwise approach is the means of demonstrating the steps which have been taken towards securing a net benefit for biodiversity. In doing so, planning

[13] Available at https://www.gov.wales/sites/default/files/publications/2024-02/planning-policy-wales-edition-12_1.pdf [Accessed:21/01/25]

authorities must also take account of and promote resilience of ecosystems, in particular the attributes known as the DECCA Framework[14].

c) **Protection for Sites of Special Scientific Interest (SSSI's)**: strengthened approach to the protection of SSSIs.

d) **Trees and Woodlands**: closer alignment with the stepwise approach, along with promoting new planting as part of development based on securing the right tree in the right place. Planning authorities must protect trees, hedgerows, groups of trees and areas of woodland where they have ecological value, contribute to the character or amenity of a particular locality, or perform a beneficial green infrastructure function.

8.2.11 Future Wales: The National Plan 2040[15] provides a framework that sets the direction for development in Wales to 2040. The plan is concerned with infrastructure and development in Wales and aims to ensure that the planning system is consistent at all levels. The National Plan introduced specific policies that safeguard areas for the purposes of improving the resilience of ecological networks and ecosystems services, to identify areas for the provision of green infrastructure, and to secure biodiversity enhancement. It introduced a requirement for developments to deliver a net benefit for biodiversity (NBB).

8.2.12 Policy 9 – (Resilient Ecological Networks and Green Infrastructure) of The National Plan states:

'the Welsh Government will work with key partners to ensure the enhancement of biodiversity, the resilience of ecosystems and the provision of green infrastructure'

8.2.13 Technical Advice Note (TAN) 5 relates to nature conservation and planning (Welsh Assembly Government 2009)[16] and provides advice on how the land use planning system should contribute to protecting and enhancing biodiversity and geological conservation. The TAN provides advice for local planning authorities on:

[14] Available at Ecosystem Resilience in a Nutshell 1: what is ecosystem resilience? (cyfoethnaturiol.cymru) [Accessed 21/01/25]
[15] Available at Future Wales: The National Plan 2040. [Accessed:21/01/25]
[16] Technical Advice Note 5: Nature Conservation and Planning Available at https://www.gov.wales/technical-advice-note-tan-5-nature-conservation-and-planning [Accessed 27/01/2025]

a) The key principles of positive planning for nature conservation;

b) Nature conservation and Local Development Plans.

c) Nature conservation in development management procedures.

d) Development affecting protected internationally and nationally designated sites and habitats.

e) Development affecting protected and priority habitats and species.

8.2.14 The *Trunk Road Estate Biodiversity Action Plan (TREBAP)* was developed for the period 2004 – 2014[17] to guide biodiversity management on the Welsh trunk-road 'soft estate'.

8.2.15 Although its original ten-year horizon has passed, the plan's principles of setting practical targets, conserving priority species and habitats, and embedding best practice in routine maintenance still underpin day-to-day operations.

8.2.16 Since TREBAP's publication, the policy landscape has moved on:

- Biodiversity remains a statutory duty. Section 6 of the Environment (Wales) Act 2016 and Section 7 priority lists require Welsh Ministers and highway authorities to maintain and enhance biodiversity on the road network.

- National frameworks such as the Natural Resources Policy (2017) and the Nature Recovery Action Plan for Wales (2015, now being refreshed to align with the Kunming-Montreal Global Biodiversity Framework) provide wider direction.

- At UK level, the 2024 UK Biodiversity Framework has replaced earlier strategies and emphasises country-led delivery through updated National Biodiversity Strategies and Action Plans (NBSAPs).

8.2.17 *Llwybr Newydd i Natur - The Welsh Strategic Road Network Nature Recovery Action Plan*[18] – was published in October 2023 to support the Wales Transport

[17] Available at Trunk Road Estate Biodiversity Action Plan (TREBAP) [Accessed 20/01/2025]
[18] Available at https://www.gov.wales/llwybr-newydd-i-natur-nature-recovery-action-plan-our-strategic-road-network [Accessed 29/07/2025]

Strategy *Llwybr Newydd* (2021), Llwybr Newydd i Natur is the live, second-generation plan for biodiversity on trunk roads and motorways. It:

- Extends the scope of TREBAP, shifting from discrete habitat/species actions to a whole-network nature-recovery approach that addresses habitat connectivity, ecosystem resilience, carbon, pollution, and supply-chain impacts.
- Embeds current duties under the Environment (Wales) Act, the Well-being of Future Generations Act, and the Welsh Government's climate-and-nature emergency commitments.
- Sets an open-ended action framework for Welsh Government, North & Mid Wales Trunk Road Agent, and South Wales Trunk Road Agent, with periodic reviews rather than a fixed end date.

Local planning policy

8.2.18 The Scheme lies within the administrative area of Flintshire County Council (FCC). For the purposes of the ecology and nature conservation assessment, relevant policies from this local planning authority have been considered. FCC adopted their Local Development Plan (LDP) on the 24th January 2023 and it covers the period 2015 – 2030[19]. It forms part of the statutory development plan alongside The National Plan.

8.2.19 Policies STR13 (Natural and Built Environment, Green Network and Infrastructure), EN2 (Green Infrastructure) and EN6 (Sites of Biodiversity Importance) of the LDP are considered relevant to the Scheme.

8.2.20 FCC has a number of plans and policies to safeguard its nature conservation interests. These include:

[19] Available at https://www.flintshire.gov.uk/en/Resident/Planning/Local-Development-Plan.aspx [Accessed:21/01/25]

a) Flintshire County Councils' Biodiversity plan "Supporting Nature in Flintshire 2020 - 2023[20]" has been produced in response to the 'enhanced biodiversity and resilience of ecosystems' duty under Section 6 of the Environment (Wales) Act 2016. The Act requires that Public Authorities must seek to maintain and enhance biodiversity so far as is consistent with the proper exercise of their functions and in so doing promote the resilience of ecosystems.

b) Biodiversity and Ecosystem Resilience Duty Delivery Plan Section 6 Environment (Wales) Act 2016 Flintshire County Council: Report Dec 201921.

Biodiversity policy and net benefits for biodiversity

8.2.21 Wales Biodiversity Partnership[22] have produced biodiversity checklists for local authority and public authority staff in Wales. The checklists will assist public and local authorities to take account of biodiversity in their operational activities and will help organisations to remain legal under the Environment (Wales) Act (2016) Biodiversity Duty, Habitats Regulations and other biodiversity related legislation. In addition, the implementation of the checklists and guidance will help build towards the biodiversity outcomes contained in the Environment Strategy for Wales. The Welsh Government work with the Partnership to improve and support our ecosystems.

8.2.22 The net-benefits for biodiversity approach by The Welsh Government has the intention to deliver an overall improvement in biodiversity by putting an emphasis on proactive consideration of biodiversity and wider ecosystem benefits within a placemaking context to be considered early in the design process[23].

8.2.23 The current adopted approach does not utilise a metric, or calculation of biodiversity 'units', as has generally been adopted in England. The Welsh Government is working with Natural Resources Wales (NRW) and other stakeholders to develop a common approach to measure whether a net benefit

[20] Available at 2120/14390 Supporting Nature in Flintshire Plan.indd [Accessed 20/01/2025]
[21] Available at Biodiversity and Ecosystem Resilience Duty Delivery Plan [Accessed 20/01/2025]
[22] Available at https://www.gov.wales/wales-biodiversity-partnership [Accessed 21/01/25]
[23] CIEEM (September 2022) Welsh Government's Approach to Net Benefits for Biodiversity and the DECCA Framework in the Terrestrial Planning System CIEEM Briefing Paper. Available at https://cieem.net/wp-content/uploads/2022/08/Net-Benefits-briefing.pdf [Accessed 11/09/240

will be achieved on a site, with further guidance forthcoming. The aim is to help users achieve biodiversity benefits by using the DECCA (Diversity, Extent, Condition, Connectivity and Aspects of ecosystem resilience) criteria.

Neighbouring authorities

8.2.24 The Scheme is not likely to have any effect on nature conservation matters within the scope of neighbouring authorities. The Dee Estuary SAC/SPA/Ramsar is located within the Flintshire, Wirral, Cheshire West and Cheshire Authorities. A management plan covering these sites has been produced by Natural England and the Countryside Council for Wales (now NRW) which will be considered in the scope of this assessment and the associated Habitat Regulations Assessment.

8.3 Assessment Methodology

8.3.1 The following relevant guidance, plans and initiatives have been considered in the production of this assessment:

a) DMRB LA 108 Biodiversity

b) DMRB LD 118 Biodiversity Design

c) DMRB LA 115 Habitat Regulations Assessment

d) CIEEM Guidelines for Ecological Impact Assessment in the UK and Ireland

e) The UK Bat Mitigation Guidelines[24]

f) FCC Section 6 Biodiversity Duty Delivery Plan

g) Nature Recovery Action Plan (NRAP)[25]

h) Flintshire Biodiversity and Ecosystem Resilience Duty Delivery plan

i) Llwybr Newydd I Natur: The Welsh Strategic Road Network Nature Recovery Action Plan for our Strategic Road Network – October 2023[26]

[24] Reason, P.F. and Wray, S. (2023). UK Bat Mitigation Guidelines: a guide to impact assessment, mitigation and compensation for developments affecting bats. Version 1.1. Chartered Institute of Ecology and Environmental Management, Ampfield
[25] Available at https://www.bionetwales.co.uk/nature-recovery-plan/ . [Accessed 21/01/25]
[26] Available at https://www.gov.wales/sites/default/files/publications/2023-10/llwybr-newydd-i-natur-nature-recovery-action-plan-our-strategic-road-network.pdf [Accessed 21/01/25]

j) Llwybr Newydd: the Wales transport strategy (March 2021)[27]

8.3.2 LA 108 provides a framework for assessing, mitigating and reporting the impact on biodiversity resources. This document has been influenced by CIEEM's Guidelines for Ecological Impact Assessment in the UK and Ireland[28].

8.3.3 LD 118 provides principles for the biodiversity design and ecological survey for the construction, improvement and maintenance of motorways and all-purpose trunk roads.

8.3.4 LA 115 sets out the requirements for assessment and reporting of the implications, from construction, operation and maintenance, of highways and/or roads projects on European sites (i.e. sites within the national site network on land and at sea). A separate Habitat Regulations Assessment has been produced which would set out the assessment methodology in full.

Study area 'Zone of Influence'

8.3.5 The 'zone of influence' has been established based on the features of interest and how they may be affected by biophysical changes as a result of the proposed Scheme and associated activities during construction, demolition, operation and restoration. This would include the Scheme boundary and any off-site ancillary works or areas, construction footprint, including potential construction compounds, haul routes, borrow pits and temporary land take.

8.3.6 The 'zone of influence' to inform the desk study for the Scheme extended to:

a) 30 km for Special Areas of Conservation designated for bats

b) 10 km for other designated sites which form the national site network (SPA's, and SAC non bats)

c) 5 km for nationally designated sites, such as SSSIs and Local Nature Reserves (LNRs)

d) 2 km for locally designated Wildlife Sites.

[27] Available at https://www.gov.wales/llwybr-newydd-wales-transport-strategy-2021 [Accessed 21/01/25]
28 https://cieem.net/wp-content/uploads/2018/08/EcIA-Guidelines-v1.3-Sept-2024.pdf

8.3.7 For protected and otherwise notable species the desk study area extends to 2 km and includes records within the last 10 years.

8.3.8 The study area for terrestrial ecological field surveys included all land affected by the project and immediately adjacent areas where accessible. To identify ponds for assessment, aerial photography and OS base mapping up to a buffer of 500m was used.

Approach to the identification of baseline conditions

8.3.9 An ecology desk study was undertaken in June 2018, which was subsequently updated in 2020, 2022 and 2025. Records were obtained from Cofnod (the biological records centre for North Wales) to identify designated sites and protected habitats or species within the 'zones of influence' detailed in Paragraph 8.3.6. Cofnod records include wildlife casualties found on roads, where this data is provided to the record centre.

8.3.10 Surveys were conducted following best practice guidance, **Table 8-1** summarises the surveys that have been undertaken to date along with key findings.

8.3.11 The normal validity period for ecology surveys is 1 - 2 years dependent upon species or habitat being surveyed[29]. Surveys completed during this study may require further updating or re-validation as the Scheme progresses.

Table 8-1 Summary of surveys 2018 – 2025

Survey type	Date survey completed	Survey details	Summary of findings
Desk Study Data	June 2018, June 2020, Sept 2022, Jan 2025	COFNOD data retrieval	Protected species records and designated sites.
Phase 1 Habitat Survey	June and October 2018, June 2020, 2022, and 2024	Phase 1 habitat surveys, target noting plant species of importance and INNS.	Noted habitats recorded onto Phase 1 habitat plans. 2024 surveys included the former Airbus Load Out Facility (ALOF) which, at the time of surveying was being considered for

[29] CIEEM (April 2019) Advice Note on the Lifespan of Ecological Reports and Surveys. Available at https://cieem.net/wp-content/uploads/2019/04/Advice-Note.pdf [Accessed 21/01/25]

Survey type	Date survey completed	Survey details	Summary of findings
			assembly of a jack up barge required for the construction of the river piers. This site has since been excluded from the scheme.
Great Crested Newt Habitat Appraisal/ Surveys	July 2018. 5th June 2020, 24th June 2021, 27th June 2022, 21st June 2024, 20th May and 19th June 2025	Habitat Suitability Index	Seven ponds assessed over the survey period, ranging between poor to good. Ponds RMLP3 and RMLP5 routinely dry and were scoped out. Queensferry Drain scoped out as it is brackish and tidal – based on observation of upstream tidal flow at high tide[30].
Great Crested Newt Habitat eDNA surveys	22nd June 2020 (RMLP1 only) 24th June 2021 and 27th June 2022 (all suitable ponds), 21st June 2024 (to accessible ponds), 20th May and 19th June 2025 (accessible ponds)	eDNA surveys	Results of the eDNA surveys highlighted one pond (RMLP4) as positive for GCN. This status is unlikely to change. Pond deteriorated in 2022 and no access in 2024. Accessed in 2025, water levels very low. SPEN ecologists conducted eDNA on ponds in 2023 in relation to works to an overhead powerline within the Scheme footprint. eDNA data was negative for the ponds they surveyed. No presence/absence surveys have been conducted; this was approved in principle by NRW.
Badger surveys	July 2018 and as part of extended Phase 1 in 2020 and 2022. Updated walkover and deployment of camera traps in 2023 and 2024.	Confirming badger movements around the proposed development site and locating any setts and any additional areas where access not permitted. Bait marking surveys are not deemed as necessary to inform Scheme options.	Sett in close proximity (just within 30 m) of construction site boundary. Badger activity within the Scheme area including for passage.
Otters and water voles	July and Sept 2018, June 2020 (otter). July and October 2020 (Water vole). July and October 2022 (otter and water vole). July and September 2024 (otter and water vole).	Walkover of suitable habitats including the River Dee and Queensferry drain. Presence absence surveys for water voles within Queensferry drain and eDNA.	No evidence of water voles noted during the surveys conducted in 2018 and 2020, but previous surveys have indicated presence and prints noted under the bridge in 2022 but no other field signs. Evidence of otters along the River Dee, field signs.

[30] *Video evidence is available showing tidal movement in the opposite direction (i.e. upstream).*

Survey type	Date survey completed	Survey details	Summary of findings
Overwintering bird surveys	Nov 2018 and Feb 2019 (inclusive). Nov 2020 – Feb 2021 November 2022 to January 2023 *Reporting for the September 2024 to March 2025 season is currently underway*	Low tide counts and wintering bird surveys conducted once a month.	Notable bird species recorded including Schedule 1, birds of Principal Importance in Wales and Red List Birds of Conservation Concern. The Dee Estuary Ramsar/SPA sites supports internationally important populations of several species. Surveys conducted to date have identified wintering species utilising the fields and the riverbanks within the site extent.
Breeding Bird Surveys	1 April to 31 July 2021 April – July 2023 *Reporting to cover the 2025 breeding bird season is currently underway*	The survey methodology applied for the breeding bird surveys broadly followed that used for the Breeding Bird Survey (BBS). Six survey visits of three days each.	Notable bird species recorded including Schedule 1, birds of Principal Importance in Wales and Red List Birds of Conservation Concern.
Reptile presence/ absence surveys	Presence/Absence surveys, Sept - Oct 2018 July – August 2020 July – Sept 2022 July – Sept 2023	Refugia was deployed within suitable land. Seven presence/absence surveys were conducted, in suitable weather conditions.	No evidence during surveys conducted to date. Scoped out of future surveys due to lack of evidence.
Assessment of PRF of trees and structures	June and October 2018. Updated 9th of June 2020 and 22nd June 2020 30th June 2022 during updated walkovers in 2023 and 2024	Potential Roost Features[31], assessment of trees and structures affected by the Scheme proposal.	Trees identified as having Potential Roost Feature M (PRF-M) for bats have become subject to damage from storms etc, so valuation has decreased. All trees categorised as having PRF-I. Structures have been identified as supporting bat roosts, identified as bat roost and would be subject to a licence from NRW.
Bat surveys on trees – emergence / return to roost	June and Sept 2020	Emergence and return to roost surveys conducted to trees with moderate potential, conducted in 2020. No evidence noted.	During the updated PRA conducted in 2022. It was noted that storm damage had resulted in tree loss which removed the roosting potential of these and

[31] In September 2023 the Bat Conservation Trust's 4th-edition Bat Surveys for Professional Ecologists replaced the old low, moderate and high-suitability tree categories with a feature-based system that classes each potential roost as PRF-I (adequate only for a single bat or very small numbers) or PRF-M (large enough to support multiple bats, including maternity colonies), so that survey and mitigation effort can be targeted in proportion to the feature's ecological value.

Survey type	Date survey completed	Survey details	Summary of findings
			other trees, as such no further activity surveys were necessary. During PRA's conducted in 2023 and 2024 no further trees were considered to have moderate potential for bats negating the need for further emergence surveys.
Activity survey emergence /return to roost bat surveys structures	July – Sept 2018 June – September 2020, July - October 2022 May – September 2024	Survey of buildings/structures to be demolished. Bat roosts discovered in two structures.	Structures identified as bat roost would be subject to licence from NRW.
Bat Activity Surveys transects	July – Sept 2018 June, August and Sept 2020 July – October 2022 and May 2023. May – September 2024	Activity transects within the Scheme footprint and the deployment of static bat detectors.	The bat transect surveys and deployment of statics conducted to date have identified eight species of bat within the Scheme area, including the common and soprano pipistrelle, whiskered / Brandt's, noctule, natterers, Daubenton's, lesser horseshoe bat and brown long-eared bat.

Extended Phase 1 Habitat Survey

8.3.12 The Extended Phase 1 Habitat survey involved undertaking a detailed walkover across the site, where access was permissible and possible. Observations of flora and fauna, along with their location and extent of habitats, were noted. The site and its habitats were also assessed for their potential to support protected and otherwise notable species.

8.3.13 The Extended Phase 1 Habitat Survey was conducted in accordance with the guidelines set out in the Handbook for Phase 1 Habitat Survey (JNCC, 2010)[32]. The extent of each observed habitat is mapped in **Figures 8.3A – 8.3E**, Volume 2 of the ES.

[32] JNCC, 2010. *Handbook for Phase 1 Habitat Survey: A technique for environmental audit.* 3rd ed. Peterborough: Joint Nature Conservation Committee.

8.3.14 The presence of any Invasive Non-Native Species (INNS) was also noted and marked up on the Phase 1 habitat plans.

Great Crested Newt Habitat Appraisal

8.3.15 Ponds within 500 m of the Scheme were assessed for their habitat connectivity. An habitat appraisal, of accessible ponds, was conducted in 2018 and updated in 2020, 2021, 2022, 2024 and 2025.

8.3.16 The Habitat Suitability Index (HSI) assessment follows a standardised process[33] using habitat components such as water quality, fish and/or waterfowl presence, and surrounding terrestrial habitat quality to derive a suitability score or 'index'. Water bodies with high scores are considered more likely to support great crested newts (GCNs) than those with lower scores. HSI score ranges and the inferred suitability of ponds to support GCN are listed in **Table 8-2**. The locations of the ponds are provided on **Figures 8.4A – 8.4C**, Volume 2 of the ES).

Table 8-2 Habitat Suitability Index scores

HSI Score	Habitat Suitability
<0.5	Poor suitability
0.5 – 0.59	Below average suitability
0.6 – 0.69	Average suitability
0.7 – 0.79	Good suitability
>0.8	Excellent suitability

Great Crested Newt eDNA

8.3.17 Samples were collected by Donna Hall MCIEEM, a licensed surveyor, accompanied by Accredited Agents Robert Jones ACIEEM and Katy Morris ACIEEM, in conjunction with the HSI, to accessible ponds.

[33] ARG UK (2010). ARG UK Advice Note 5: *Great Crested Newt Habitat Suitability Index.* Amphibian and Reptile Groups of the United Kingdom

8.3.18 The protocol for sampling followed that outlined within the technical advice note for field and laboratory sampling of great crested newts[34] which requires the collection of 20 x 30 ml subsamples from the pond, spaced as evenly as possible around the margin. Once collected, the samples were sent off for analysis to SureScreen Scientifics.

8.3.19 Natural Resources Wales guidance[35] accepts the use of eDNA surveys as evidence of presence or absence of great crested newts, provided samples are taken when newts are likely to be present. Natural Resources Wales will only accept eDNA survey results undertaken between mid-April and 30th June, in strict accordance with the published technical advice note, by suitably trained, experienced and licensed great crested newt surveyors.

Badger surveys

8.3.20 Badger surveys were undertaken within the proposed Scheme boundary and adjacent areas, where access was permissible and possible, following guidance set out in Harris *et al.,* (1989)[36]. Within this search area all habitats were systematically surveyed for evidence of badgers, in the form of:

a) Latrines
b) Setts
c) Pathways
d) Scratch marks
e) Snuffle holes
f) Footprints
g) Guard hairs

[34] Biggs, J., Ewald, N., Valentini, A., Gaboriaud, C., Griffiths, R. A., Foster, J., Wiilkinson, J., Arnett, aA, Williams, P., & Dunn, F. (2014). analytical and methodological development for improved surveillance of the great crested newt defra project wc1067 appendix 5. oxford: freshwater habitats trust
[35] Available at https://naturalresources.wales/permits-and-permissions/species-licensing/list-of-protected-species/the-use-of-environmental-dna-test-for-great-crested-newt-licensing-purposes/?lang=en [Accessed 27/01/2025]. NB: This guidance may be updated.
[36] Harris S, Cresswell P and Jefferies D (1989) *Surveying Badgers*, Mammal Society

8.3.21 Classification of setts based on the above methodology is set out as follows:

a) **Main sett;** these usually have a large number of holes with conspicuous spoil heaps, and the sett generally looks very active. There will be well used paths to and from the sett and between sett entrances. Although normally the breeding sett and in continuous use, it is possible to find a main sett that has become disused due to excessive interference or some other reason; it should be recorded as a disused main sett. Disused main setts are particularly common in areas of low badger density.

b) **Annexe sett;** these are close to a main sett, normally less than 150 m away, and are usually connected to the main sett by one or more obvious well-worn paths. They usually have several holes but may not be in use all of the time, even if the main sett is very active.

c) **Subsidiary sett;** these often have only a few holes; three to five might be the average number in most areas. They are usually at least 50 m from the main sett, and do not have any obvious path connecting with another sett. They are not continuously active.

d) **Outlying sett;** these usually have only one or two holes, often have little spoil outside the hole, have no obvious path connecting with another sett, and are only used sporadically. When not in use by badgers they may be taken over by foxes or even rabbits.

8.3.22 Classification of holes based on the above methodology is set out as follows:

a) **Well used holes;** these are clear of any debris or vegetation, obviously in regular use, and may or may not have been excavated recently.

b) **Partially used holes;** these are not in regular use and have debris such as leaves or twigs in the entrance or have moss and/or other plants growing in or around the entrance. Partially used holes could be in regular use after a minimal amount of clearance.

c) **Disused holes**; these have not been in use for some time, are partially or completely blocked, and cannot be used without a considerable amount of clearance. If the hole has been disused for some time, all that may be visible is a depression in the ground where the hole used to be, and the remains of the spoil heap, which may be covered by moss or plants

8.3.23 The surveys were undertaken as part of the extended Phase 1 habitat surveys, including subsequent updates and were supplemented by deploying camera traps along sett entrances or noted pathways. Any evidence observed was marked on plans labelled as confidential.

Otter surveys

8.3.24 For otters, the survey included the Queensferry Drain and River Dee, 500 m upstream and downstream of the existing bridge, where access was permissible and possible. A habitat assessment and search for field signs was carried out following guidance set out within Chanin (2003) Life in UK Rivers survey guidelines[37]. In addition, a camera trap was positioned under a stone slab which was identified as a potential rest up area. This was left in position for two weeks in October 2022.

8.3.25 The survey effort is considered proportionate for the Scheme, on this type of river within an urban environment and is sufficient to inform the assessment of effects and to advise on appropriate and proportionate mitigation.

Water voles

8.3.26 For water voles, the survey included a habitat assessment and search for field signs carried out across the Queensferry Drain area and the River Dee. The methodology used for the habitat assessment was taken from Cheshire Wildlife Trust, adapted from Harris *et al*., (2009). The field survey was based on the Mammal Society guidelines for undertaking water vole surveys. Droppings were collected and sent to SureScreen Scientifics for eDNA analysis.

Ornithology – overwintering and breeding birds

8.3.27 Overwintering and breeding bird surveys have been conducted by Mott MacDonald Limited (MML) specialists.

8.3.28 The survey programme consisted of low tide counts and wintering bird surveys conducted once a month within the recommended survey period.

8.3.29 The survey methodology applied for the breeding bird surveys broadly followed that used for the Breeding Bird Survey (BBS), devised by the British Trust for

[37] Chanin, P. (2003). *Monitoring the Otter Lutra lutra*. Conserving Natura 2000 Rivers Monitoring Series No. 10, English Nature, Peterborough.

Ornithology (BTO), Joint Nature Conservation Committee (JNCC) and the Royal Society for the Protection of Birds (RSPB). The BBS methodology uses a distance and mapping method in which a series of visits are made to a site during the breeding season, and observations of birds, by sight or sound are recorded. The surveys for this Scheme entailed birds recorded on a large-scale map in accordance with the developmental project.

8.3.30 Further details on the methodology and findings are presented in the associated survey reports provided in **Appendix 8B**, Volume 3 of the ES.

Reptile surveys

8.3.31 A presence / absence survey for reptiles was conducted within suitable habitat likely to be affected by the Scheme. This included areas adjacent to the Queensferry Drain, habitat within the wastewater treatment works and along the footpath adjacent to the treatment works which leads from Chemistry Lane to the River Dee and an area of open disused land (a former scrap yard located to the north of the wastewater treatment works and adjacent to the Riverside gypsy traveller site).

8.3.32 The surveys were carried out following guidance as set out within Froglife[38]. A total of approximately 100 refugia mats were deployed and left to bed in for a minimum of two weeks. They were then inspected seven times in suitable weather conditions.

8.3.33 A location plan of the survey areas and refugia is provided on **Figure 8.6**, Volume 2 of the ES.

Preliminary Roost Assessment (PRA) – Bats

8.3.34 All trees were inspected from ground level with the aid of close-focus binoculars and a high-powered torch. Trees were assessed for the presence of potential

[38] Froglife Advice Sheet 10. Froglife, Halesworth (1999).

roosting features (PRF) and signs of bat presence. The surveys were conducted as part of the extended Phase 1 habitat and arboricultural surveys.

8.3.35 All structures (buildings and bridges) to be directly affected by the Scheme were subject to an external and internal inspection (where access was permissible and possible). Surveyors were equipped with ladders, a high-powered torch and endoscope.

8.3.36 The BCT Bat Survey Good Practice Guidelines (BCT. 2023[39]) were used as a basis to evaluate the site features for their potential to support bats. **Table 8-3** gives an indication of the value of a variety of features for bats and has been compiled using the BCT Bat Survey Guidelines. Structures and trees were assigned a value between none and high/confirmed, with PRF's of trees additionally assigned a value of negligible, PRF-I[40] or PRF-M[41].

Table 8-3 Assessment of development sites for bats[42]

Potential suitability	Description	
	Roosting habitats in structures	**Potential flightpaths and foraging habitats**
None	No habitat features on site likely to be used by any roosting bats at any time of the year.	No habitat features on site likely to be used by any commuting or foraging bats at any time of the year.
Negligible	No obvious features on site likely to be used by roosting bats.	No obvious features on site likely to be used as flight paths or by foraging bats.
Low	A structure with one or more potential roost features that could be used by individual bats opportunistically at any time of year. Non maternity and non-hibernacula. PRF-I trees – refer to table 7.1 of BCT Guidelines)	Habitat that could be used by a small number of bats as flight paths, but isolated and not well connected to surrounding landscape. Suitable but isolated habitat.
Moderate	A structure with one or more potential roost features that could be used by a number of bats due to their size, shelter, protection conditions and surrounding habitat but unlikely to	Continuous habitat connected to the wider landscape that could be used by bats for flightpaths and foraging.

[39] Collins, J (ed.) (2023) Bat Surveys for Professional Ecologists: Good Practice Guidelines (4th edn). The Bat Conservation Trust, London.
[40] PRF is only suitable for individual bats or very small numbers of bats due to their size or lack of suitable surrounding habitat.
[41] PRF is suitable for multiple bats.
[42] Adapted from Table 4.1 of the BCT Guidelines.

Potential suitability	Description	
	Roosting habitats in structures	**Potential flightpaths and foraging habitats**
	support a roost of high conservation status. PRF-M trees – refer to table 7.1 of BCT Guidelines)	
High	A structure with one or more potential roost features that are obviously suitable for use by larger numbers of bats on a more regular basis for longer periods of time. High potential to support maternity roosts and provide stable environments for hibernation.	Continuous high-quality habitat that is well connected and used regularly for foraging and commuting. Site is close to and connected to known roosts.
Confirmed	Confirmed roost (from evidence collected during surveys).	

8.3.37 Wray *et al*., (2023)[43] developed a method for the evaluation of bats in environmental assessment which considers various factors including: the rarity of the bat species, number of passes, number of roosts or potential roosts within the proximity and the surrounding habitat. This methodology has been taken into consideration during the assessment and assigning of a value to this receptor.

Bat activity surveys – emergence / return to roost surveys

8.3.38 Emergence and return to roost surveys were conducted on trees identified as having the potential to support bat roosts on the 9th June 2020 and 8th September 2020. No evidence of bats was noted.

8.3.39 During the updated PRA's conducted in 2022-2024, it was noted that storm damage had resulted in tree loss which removed the roosting potential of these and other trees, with many fallen trees, as such no further surveys were necessary. No further trees were considered to have above PRF- I potential for bats and required no further survey work.

[43] Reason, P.F. and Wray, S. (2023). UK Bat Mitigation Guidelines: a guide to impact assessment, mitigation and compensation for developments affecting bats. Chartered Institute of Ecology and Environmental Management, Ampfield.

8.3.40 Emergence / return to roost surveys were conducted on structures to be demolished as part of the scheme and with low - high potential in 2018, 2020, 2022 and 2024. Structures subject to surveys included:

a) 1 – 4 Chester Road East properties
b) Electricity Substation and Queensferry Auto Repairs
c) Electricity Substation within NRW pumping station, Queensferry Drain
d) Flintshire Depot

8.3.41 Over the survey period, surveyors were equipped with either Anabat Express, Anabat Walkabout, Scout, magenta, Anabat swift, Echo Touch Meter 2 or bat box duet bat detectors. For surveys conducted from 2022, Night Vision Aids (NVAs) in the form of thermal imaging binoculars x 1 and monocular x 3 were used.

8.3.42 During the surveys any bat activity was noted by the surveyors, including species, the locations of any emerging bats, flight paths, general activity, commuting, foraging and the timings of these encounters.

8.3.43 At structures, surveyors were positioned focusing on those features that had been identified during the preliminary roost inspections so as to be able to observe any bats leaving or entering roosts.

8.3.44 During the surveys, the following details were noted:

a) Weather and temperature;
b) Time bat detected/seen;
c) Frequency (kHz) at which the bat was detected;
d) Whether the bat emerged/returned to roost and location;
e) Direction of flight;
f) Species of bat; and
g) Number of bats present

8.3.45 After the completion of each survey session, digital bat recordings were analysed using Anabat Insight analysis software to confirm species identification.

8.3.46 Those properties and trees surveyed are detailed in **Table 8-4** and their locations are shown on **Figures 8.5A – 8.5O**, Volume 2 of the ES.

Table 8-4 Properties and trees subject to dusk and dawn surveys

Structure Name/ Tree reference	Date of survey	Dusk/dawn	Number of surveyors	Equipment
Garage 1	09/08/2018 06/08/2020 26/07/2022 14/08/2024	Dusk	1	Anabat walkabout x 1 Thermal monocular
Electricity sub station south of Chester Road east	09/08/2018 06/08/2020 26/07/2022 14/08/2024	Dusk	2	Bat box duet x 1 Anabat walkabout x 2 Acolade thermal imaging and night vision binoculars x1
1 – 4 Chester Road East, Terrace properties	25/07/2018, 23/08/2018 13/09/2018 24/06/2020 21/07/2020 29/09/2020 10/08/2022 23/08/2022 03/10/2022 04/07/2024 25/07/2024 18/09/2024	Dusk and dawn (2018) Dusk Dusk Dusk	4-5	Bat box duet x 2 Anabat walkabout x 3 Acolade thermal imaging and night vision binoculars x 1 Thermal monocular x 3 Anabat Express x 2
Flintshire Depot buildings 1 and 2	29/08/2018 05/08/2020 27/07/2022 10/07/2024	Dusk	4-5	Bat box duet x 2 Anabat walkabout x 3 Acolade thermal imaging and night vision binoculars x1 Thermal monocular x 3 Anabat Express x 2
Queensferry Electricity sub station adjacent to NRW pumping station	16/08/2018 22/06/2020 13/08/2020 15/09/2020 06/07/2022 11/08/2022 28/09/2022 16/07/2024 22/08/2024 12/09/2024	Dusk	2	Bat box duet x 1 Anabat walkabout x 2 Acolade thermal imaging and night vision binoculars x1 Thermal monocular x 1
Tree TR1 – Hybrid black poplar on footpath leading from Chemistry	09/06/2020 08/09/2020	Dusk Dawn	1	Bat box duet x 1 Anabat walkabout x 1 Acolade thermal imaging and night vision binoculars x 1

Structure Name/ Tree reference	Date of survey	Dusk/dawn	Number of surveyors	Equipment
Lane adjacent to WTW.				
Tree TR2 - Hybrid black poplar on footpath leading from Chemistry Lane adjacent to WTW.	09/06/2020 08/09/2020	Dusk Dawn	1	Bat box duet x 1 Anabat walkabout x 1 Acolade thermal imaging and night vision binoculars x 1

8.3.47 The two trees (TR1 and TR2) which were identified as having moderate roost potential were subject to 'emergence' and 'return to roost' surveys in 2020. During the updated PRA's conducted in subsequent years, it was noted that storm damage had resulted in tree loss which removed the roosting potential of these and other trees, as such no further surveys were necessary. No further trees were considered to have moderate potential for bats and required further survey work.

Bat Activity Survey – Night-time Bat Walkover (NBW) Survey

8.3.48 Three pre-determined transects on each side of the A494 crossing were walked slowly by the surveyors using visual observations and recordings from bat detectors to identify bat activity and species.

8.3.49 Surveyors stopped for five minutes at locations along the route to gain additional information at 'high risk' locations, i.e., those where suitable habitats would be affected. All surveys were conducted in suitable weather conditions.

8.3.50 The bat transect routes are shown on **Figures 8.5A – 8.5O**, Volume 2 of the ES.

8.3.51 Survey dates are provided in **Table 8-5** below.

Table 8-5 NBW survey dates 2018 - 2024

Date of survey	Dusk/dawn	Number of surveyors	Equipment
26/07/2018 15/08/2018 06/09/2018	Dusk Dusk (reversed) Dusk	2	Anabat walkabout x 1

Date of survey	Dusk/dawn	Number of surveyors	Equipment
04/06/2020 04/08/2020 22/09/2020	Dusk Dusk (reversed) Dusk	2	Anabat walkabout x 1
12/07/2022 24/08/2022 04/10/2022	Dusk Dusk (reversed) Dusk	2	Anabat walkabout x 1 Thermal monocular
16/05/2023[44]	Dusk	2	Anabat walkabout x 1 Thermal monocular
07/05/2024 18/06/2024 24/09/2024	Dusk Dusk (reversed) Dusk	2	Anabat walkabout x 1 Thermal monocular

8.3.52 During the surveys, the following details were noted:

a) Weather and temperature;

b) Time bat detected/seen;

c) Frequency (kHz) at which the bat was detected;

d) Location within the survey area;

e) Direction of flight;

f) Species of bat;

g) Number of bats present; and

h) Whether the bats appeared to be foraging or commuting.

Deployment of static bat detectors

8.3.53 Anabat Swift Detectors were deployed, placed at areas of higher value for bats which could be affected by the Scheme where suitable locations could be reached, and detectors were not at risk from theft. The locations of the static detectors are shown on **Figures 8.5A – 8.5O**, Volume 2 of the ES. The arrows on the figures represent the direction that the microphone was facing. Deployment dates and location descriptions are provided in **Table 8-6**.

Table 8-6 Static detector survey dates 2018 - 2024

Static Ref	Location description	Survey period	Month
ST3	Queensferry drain	10/07/2018-15/07/2018	July

[44] Only one survey conduced this season to capture the survey period April/May which was missed during previous surveys owing to access permissions.

Static Ref	Location description	Survey period	Month
ST4 and ST2	Terrace property gardens	23/08/2018-28/08/2018 21/07/2020-26/07/2020 10/08/2022-15/08/2022 03/10/2022-10/10/2022 04/07/2024-10/07/2024 11/09/2024-16/09/2024	August July August October July September
ST1	DCWW land north within scrub	17/09/2018-23/09/2018	September
ST2	DCWW land south within scrub adjacent to tree line	17/09/2018-23/09/2018	September
ST1	Plantation woodland behind Flintshire Depot	04/06/2020-08/06/2020	June
ST3	Hybrid poplar tree line DCWW	13/08/2020-17/08/2020 08/08/2022-08/08/2022 08/09/2022-12/09/2022 16/05/2023-22/05/2023 21/06/2024-26/06/2024 11/09/2024-16/09/2024	August September May June September
ST4	DCWW land in scrub	03/08/2022-08/08/2022 23/09/2020-28/09/2020 08/09/2022-12/09/2022 16/05/2023-22/05/2023 21/06/2024-26/06/2024 11/09/2024-16/09/2024	August September May June September

Survey limitations

8.3.54 Species records obtained from Cofnod are based on surveyor effort and availability, so a lack of records may be due to lack of survey work in that particular area rather than the absence of the species.

8.3.55 The ecology field survey has been carried out from publicly accessible locations for the majority of the surveys. Permission has been obtained where required, though some areas remained inaccessible for surveys.

8.3.56 No access to conduct an internal inspection for bats within the following properties was possible, due to health and safety or access restrictions:

a) Electricity substation to west of the Scheme;
b) The four semi-detached properties on Chester Road East;
c) Queensferry pumping station and electricity substation.

8.3.57 Due to the late timing of the commission, some early survey season bat surveys were missed. However, data collated over the period between 2018 – 2024, covering all seasons within the years of survey, provides sufficient data

on local bat populations and their use of the site upon which to base the assessment of effects.

8.3.58 The deployment of static detectors was restricted due to access and the potential for theft, so not all areas could be surveyed. However, it is felt that with the locations from surveys conducted between 2018 – 2024 an adequate understanding of bat activity across the Scheme can be gained.

8.3.59 No constraints were encountered during the otter and water vole surveys.

8.3.60 No access was possible along the railway embankment. Some areas within the land owned by Welsh Water were densely vegetated and so access was restricted.

8.3.61 No constraints were identified during the reptile surveys conducted in 2018 and 2020. During surveys conducted in 2022 and 2023, several refugia were damaged by vegetation removal works conducted on behalf of Welsh Water within the wastewater treatment works and also by NRW along Queensferry Drain. Both parties had been informed of the deployment of refugia and that checks were in process.

8.3.62 For constraints encountered during the breeding and wintering bird surveys refer to the reports in **Appendix 8B**, Volume 3.

8.3.63 No presence / absence surveys for GCN have been conducted to date. However, it has been highlighted during an ELG meeting with NRW held on the 10th August 20201 that the conservation status of GCN in the vicinity is poor and that it is unlikely that presence / absence surveys would alter the assessment of effects nor the proposed mitigation.

8.3.64 During the updated habitat appraisals and eDNA sampling, several ponds were dry and access to some was restricted.

8.3.65 The limitations encountered have not affected the validity of the assessment process owing to the extensive amount of data collated over a number of years. It is considered that enough data was obtained to assess the effects of the Scheme and to advise appropriate and proportionate mitigation.

Consultations

8.3.66 This Scheme is a continuation from the A494 River Dee Bridge Improvement Scheme and will be taken forward independently of any other highways project. It does draw on information and consultations undertaken as part of the WelTAG Stage 3 study for the A494 River Dee Bridge Improvement Scheme.

8.3.67 An Environmental Liaison Group (ELG) for the A494 River Dee Bridge Improvement Scheme was constituted and held its first meeting in June 2018; further meetings continued during the preparation of the Statement for the A494 River Dee Bridge Improvement Scheme until a decision was made in 2023 to revisit the Scheme proposals as a result of the Roads Review.

8.3.68 Representatives of NRW, Flintshire County Council (FCC), NMWTRA, the Welsh Government, CADW and the project team have been involved in previous consultations and responses have been received on reports produced in respect of nature conservation interests, current at that time. The last ELG in respect of the previous Scheme was on the 26th May 2022.

8.3.69 The Overseeing Organisation re-convened the ELG meetings and hold regular meetings/and or site visits to highlight any environmental issues that need to be addressed as the Scheme progresses through the statutory process. The 7th ELG meeting took place on the 5th December 2024 with others held approximately monthly. A site visit with interested stakeholders was conducted on the 25th March 2025.

8.3.70 Previous consultation responses are provided in **Table 8-7**.

8.3.71 A recent response on a Scoping Document[45] was received from NRW on the 31st January 2025. The responses would be addressed within the appropriate section of ES.

[45] Mott Macdonald (Dec 2024) Environmental Scoping Report A494 River Dee Bridge Replacement Document reference: 395318 | MMD-00-XX-RP-Z-0010 | A |.

Table 8-7 Previous consultation responses

Date	Consultee and issue raised	Response
11th June 2018 (ELG)	Amanda Davies FCC / Bat Roost Features in the form of wooden planks reported anecdotally to be set within the Dee Bridge.	Inspections of the bridge have been carried out. No Bat Roost Potential (BRP) noted on the sub structure, bat transect survey focused on the bridge with 5-minute stopping points.
	Amanda Davies FCC and NMWTRA. Water voles noted in the Queensferry Drain in 2007. NMWTRA have conducted surveys, no records noted. Water voles noted on Sealand side in ditches.	New surveys for water voles in the Queensferry Drain were conducted for this assessment, no evidence noted. Reasonable avoidance measures to be considered.
	Amanda Davies FCC confirmed that there is a migratory fish route under the River Dee Bridge.	SAC feature. NRW count data for salmonids and lamprey obtained
	Amanda Davies FCC, the river corridor should be retained as a 'dark corridor' with no light spill from any lighting required for the road. Daubenton's bats have been seen along the river.	Sensitive lighting designs will be considered as part of the detailed design process.
	Amanda Davies FCC suggested that pollution control measures should be specified and included in the Habitat Regulations Assessment.	Noted and included.
	Amanda Davies FCC confirmed that hedges around the Scheme are not species rich.	Confirmed during the Phase 1 habitat survey.
9th October 2018 (TWG)	Matthew Ellis NRW. Deeside and Buckley Newt Sites SAC scoped out of the HRA. Consideration to be given to other designated sites.	Designated sites and features of interest will be considered as part of this and the HRA assessment. Deeside and Buckley Newt Sites SAC scoped out.
	Fisheries NRW. No major concerns about siltation effects, main concern is timing of works within River Dee.	Works will be timed to avoid sensitive periods for migratory fish. NRW to advise further once Scheme develops.
	Matthew Ellis NRW. Consideration of INNS, including the Chinese mitten crab.	Phase 1 habitat surveys to identify location of INNS. Biosecurity risk assessments to be produced and measures to be included in the Construction Environmental Management Plan (CEMP).
10th October 2018 (ELG)	Amanda Davies FCC and Mark Watson-Jones (NMWTRA) enquired about translocating saltmarsh that will be lost by the proposed Scheme.	Translocation of saltmarsh may increase the disturbance area. Minimal saltmarsh would be lost due to the Scheme. Work which improves condition elsewhere could be acceptable mitigation.
	Amanda Davies FCC highlighted that barn owls use the Dee corridor and feed on the marsh. Pink-footed geese have increased in population along the River Dee corridor.	Overwintering bird surveys will be conducted. Consultation with RSPB. Scheme will consider effects on Schedule 1 birds.
NRW response to Scoping	NRW requested modelling and calculations in order to assess the impacts to saltmarsh habitat,	The effects will be assessed within the ES and Statement to Inform Appropriate Assessment (SIAA).

Date	Consultee and issue raised	Response
(email 19th Sept 2018)	salmon, sea / river lamprey and common tern.	
FCC response to Scoping	N/A	No response but advice and comments received during the ELG which are detailed above.
2nd May 2019	NRW - The potential for the creation and/or enhancement of habitats to compensate for the loss of a small area of saltmarsh were discussed over the phone with NRW.	NRW state that potential sites will be investigated as to their suitability for management and habitat creation/enhancement.
19th June 2019	NRW – Highlighted three potential areas as compensation for the loss of a small area of saltmarsh	These areas were discussed with NMWTRA and the Welsh Government to develop proposals (see para 8.5.30).
21st June 2019	NRW – Review of the draft Environmental Statement.	Various comments which were taken into consideration and applied to the finalising of this ES.
10th August 2021 (ELG)	NRW – Species Officer highlighted the need for a derogation licence for GCN	A Ghost Licence was prepared. (*Note: as discussed in 8.4.47 - due to negative results in subsequent surveys and clearance works in that location, a licence was no longer deemed necessary*).
26th May 2022 ELG #6	ELG meeting to provide general update on scheme proposals since last ELG on 16/08/2021	Sites for saltmarsh mitigation being explored. Draft orders have been prepared for the Scheme.
5th December 2024 ELG #7	Main purpose of ELG was to review the revised and updated Environmental Objectives (EOs) that have been drafted to be more aligned with Llwybr Newydd I Natur.	New EOs agreed at the ELG.
25th March 2025 ELG Site Visit	ELG site visit to gain a general understanding of the most recent scheme proposals (Option E).	The site visit presented the opportunity for the ELG to meet face to face and discuss issues on site.
27th March 2025 ELG #8	ELG to record feedback from site visit and discuss any matters arising following the visit.	The ELG (Welsh Government, NMWTRA and FCC) would like the design team to explore more opportunities for improving biodiversity and connectivity.
14th May 2025 TWG	TWG held to discuss opportunities for improving biodiversity and connectivity.	Design team to look at feasibility of increasing connectivity through provision of mammal underpasses and longer sections of open culvert along Queensferry Drain.

Significance criteria and biodiversity resource importance

8.3.72 Baseline studies have established the relative importance of the terrestrial biodiversity resources, using the guidance in Table 3.9. of LA 108, as summarised in **Table 8-8**.

Table 8-8 Biodiversity resource importance[46]

Value (sensitivity)	Typical descriptors
International or European importance	Sites including: • Sites of Community Importance, • Special Protection Areas (SPAs); • Potential SPAs (pSPAs); • Special Areas of Conservation (SACs); • Candidate or possible SACs (cSACs or pSACs); • Wetlands of International Importance (Ramsar sites). • Biogenetic Reserves • World Heritage Sites (where recognised specifically for their biodiversity value) and Biosphere Reserves. • Areas which meet the published selection criteria for those sites listed above but which are not themselves designated as such. Resident, or regularly occurring, populations of species which can be considered at an international or European level where: 1) the loss of these populations would adversely affect the conservation status or distribution of the species at an international or European scale; or 2) the population forms a critical part of a wider population at this scale; or 3) the species is at a critical phase of its life cycle at an international or European scale.
UK or National	A nationally designated site (SSSI, ASSI, NNR, Marine Conservation Zones and Marine Protected Areas) A viable area of a priority habitat identified in Section 7 of the Environment (Wales) Act 2016, or of smaller areas of such habitat which are essential to maintain the viability of a larger whole. Any regularly occurring population of a nationally important species which is threatened or rare in the region or county. A regularly occurring significant population / number of any nationally important species, including Schedule 8 plant species on the amber list of birds of conservation concern.
Regional	Viable areas of key habitat identified in Section 7 of the Environment (Wales) Act 2016 or other plans or smaller areas of such habitat which are essential to maintain the viability of a larger whole. Areas of habitats identified (including for restoration) in regional plans or strategies. Designated sites, (non-statutory) including heritage coasts. Any regularly occurring, locally significant population of a species listed as being nationally scarce which occurs in 16-100 10.0 km squares in the UK or occurs on Section 7 or is relevant on account of its regional rarity or localisation. A regularly occurring, locally significant number of a regionally important species.
County	Semi-natural ancient woodland greater than 0.25 ha. County / District sites and other sites which the designating authority has determined meet the published ecological selection criteria for designation, including Local Nature Reserves.

[46] Adapted from: https://www.standardsforhighways.co.uk/tses/attachments/af0517ba-14d2-4a52-aa6d-1b21ba05b465

Value (sensitivity)	Typical descriptors
	Any regularly occurring, locally significant population of a species which is listed in a County "red data book" or similar on account of its regional rarity or localisation. A regularly occurring, locally significant number of a County important species on the green list of birds of conservation concern.
Local	Semi-natural ancient woodland smaller than 0.25 ha. Local sites that the designating authority has determined meet the published ecological selection criteria for designation, including Local Wildlife Sites. Sites / features that are scarce within the locality or which appreciably enrich the habitat resource. Areas of habitats identified in county or equivalent authority plans or strategies (where applicable). Areas of habitat considered to appreciably enrich the habitat resource within the local context including features of importance for migration, dispersal, or genetic exchange. Populations / communities of species considered to appreciably enrich the habitat resource within the local context including features of importance for migration, dispersal or genetic exchange.
None	Scoped out from further assessment due to limited in extent or not affected.

(adapted from Table 3.9 LA 108)

8.3.73 The assessment of the significant effects of the Scheme focuses on those ecological features identified through the baseline studies as being important. The value of an ecological feature has been determined based on professional judgement and the role of the ecological feature within the landscape, as well as considering its importance within a defined geographical context and overall resilience.

8.3.74 Various characteristics contribute to the importance of an ecological feature including whether it is internationally (former Natura 2000 sites which are now noted as those which are within the national site network), nationally, or locally important, the size of habitat or species population, habitat connectivity, rarity and robustness (resilience). This includes, for protected species, consideration of both the current conservation status (CCS) and favourable conservation status (FCS) where this information is available. In cases of reasonable doubt, where it has not been possible to justify a conclusion of no significant effect robustly, a significant effect has been assumed and, where uncertainty exists, this is acknowledged.

8.3.75 The level of impacts on terrestrial biodiversity resources have been assessed in accordance with the criteria provided in Table 3.11 of LA108 as summarised in

Table 8-9 below, taking into consideration the Guidelines for Ecological Impact Assessment for the UK and Ireland (CIEEM) and other published guidance in respect of ornithology and bats.

8.3.76 Level of impact shall be determined by the assessment of the following characteristics:

a) positive or negative (e.g. adverse/beneficial)
b) duration (e.g. permanent/temporary)
c) reversibility (e.g. irreversible/reversible)
d) extent/magnitude, and
e) frequency and timing.

Table 8-9 Level of impact and descriptors

Level of impact (Change)		Typical descriptors
Major	Beneficial	Permanent addition of, improvement to, or restoration of a biodiversity resource. The extent, magnitude, frequency and/or timing of an impact positively affects the integrity of key characteristics of the resource and the change is likely to restore an ecological receptor to favourable conservation status, or to create a feature of recognisable value within an international or national context – **major beneficial effect.**
	Adverse	The change is likely to cause a permanent (irreversible) effect on the integrity of an ecological receptor and/or biodiversity resource. The extent, magnitude, frequency and/or timing of an impact negatively affects the integrity of key characteristics of the resource – **major adverse effect.**
Moderate	Beneficial	Temporary addition of, improvement to, or restoration of a biodiversity resource. The extent, magnitude, frequency and/or timing of an impact positively affects the integrity of key characteristics of the resource and the change is likely to restore an ecological receptor to favourable conservation status, or to create a feature of recognisable value within a regional or county context – **moderate beneficial effects.**
	Adverse	Temporary/reversible damage to a biodiversity resource. The change adversely affects the valued ecological receptor, but there will probably be no permanent effect on its integrity with appropriate mitigation and is reversible – **moderate adverse effect.**
Minor	Beneficial	Permanent addition of, improvement to or restoration of a biodiversity resource. The extent, magnitude, frequency and/or timing of an impact positively affects the integrity of key characteristics of the resource and the change is likely to restore an ecological receptor to favourable conservation status, or to create a feature of recognisable value within a local context - **minor beneficial effect.**
	Adverse	The extent, magnitude, frequency and/or timing of an impact does not affect the integrity or key characteristics of the resource. The change affects the valued ecological receptor in the short term but there will be no permanent effect (reversible) – **minor adverse effect.**

Level of impact (Change)		Typical descriptors
Negligible	Beneficial	The change is likely to restore or retain the status of an ecological receptor – **negligible or slight beneficial effect**.
	Adverse	The change affects the valued ecological receptor in the short term but there will be no permanent effect (reversible) – **negligible or slight adverse effect**.
No change		No observable impact, either positive or negative.

(*adapted from Table 3.11 LA 108*)

8.3.77 The importance of the resource/receptor (**Table 8-8**) and level of impact (**Table 8-9**) would be used to determine the significance of effect based on Table 3.13 of LA108 - significance matrix as detailed in **Table 8-10**.

8.3.78 It should be noted that where the matrix spans two possible outcomes e.g. slight or moderate, the assessment would clearly set out the rationale and supporting evidence for the level of significance assigned in the assessment, and for protected features a precautionary approach would be taken in line with guidance.

Table 8-10 Significance matrix

		Level of impact				
		No change	**Negligible**	**Minor**	**Moderate**	**Major**
Resource importance	**International or European**	Neutral	Slight	Moderate or Large	Large or Very Large	Very Large
	UK or national	Neutral	Slight	Slight or Moderate	Moderate or Large	Large or Very Large
	Regional	Neutral	Neutral or slight	Slight	Moderate	Moderate or Large
	County	Neutral	Neutral or slight	Neutral or slight	Slight	Slight or Moderate
	Local	Neutral	Neutral	Neutral or slight	Neutral or slight	Slight

(*Source Table 3.13 DMRB LA108*)

8.3.79 Any significant impacts remaining after applying the mitigation hierarchy (the residual impacts), together with an assessment of the likelihood of success of the mitigation, are the factors which would to be considered against legislation, policy and development management in determining the Scheme.

8.4 Baseline Conditions

8.4.1 This section provides a summary of the key findings of the desk study and surveys undertaken to provide the baseline data for the Scheme.

Statutory designated sites

8.4.2 Information on statutory designated sites within distances of 30 km for SAC (designated for bats), 10 km for other designated sites such as SPA or Ramsar and 5 km for nationally designated sites such as SSSIs or LNRs was obtained through desk study. Designated sites which form the national site network are shown on **Figure 8.1**. Volume 2 of the ES. Other designated sites and Wildlife Sites are shown on **Figure 8.2.** No SACs designated for bats occur within 30 km of the Scheme.

Table 8-11 Statutory designated sites within the Scheme area

Site	Designation	Reason for notification	Proximity to Scheme[47]
Dee Estuary	Ramsar Site (UK11082)	Location of mud and sand flats, supports breeding Natterjack Toad, supports waterfowl.	Within 1 km northwest Tidal link
	Special Protected Area (SPA) Classified 17/07/1985	Importance for waterfowl by supporting populations of importance for wintering, breeding and migratory bird assemblages.	Within 1 km northwest Tidal link.
	Special Area of Conservation (SAC)	Annex 1 habitats Primary reason – Mudflats and sandflats, *Salicornia* spp. And Atlantic salt meadows. Noted for river and sea lamprey and Petalwort.	Within 1 km northwest Tidal link
	Site of Special Scientific Interest (SSSI) 0839	Populations of internationally important wintering waterfowl; its populations of individual waterfowl and tern species; its intertidal mud and sandflats, saltmarsh and transitional habitats; the hard rocky sandstone cliffs of Hilbre Island and Middle Eye with their cliff vegetation and maritime heathland and grassland; its assemblage of nationally scarce plants; and its populations of sandhill rustic moth (*Luperina nickerlii*	Within 1 km northwest Tidal link

[47] As taken from the center of the existing bridge

Site	Designation	Reason for notification	Proximity to Scheme[47]
		gueneei), a Red Data Book species.	
River Dee and Bala Lake Site	Special Area of Conservation (SAC)	Aquatic habitats and migratory fish, otters.	Crossed by project
River Dee	Site of Special Scientific Interest (SSSI) 2554	Fluvial geomorphology, carboniferous geology, range of river habitat types, saltmarsh transition habitats floating water plantain, slender hare's ear, sea barley, hard grass, otter, salmon, bullhead, brook lamprey, river lamprey, sea lamprey, European smelt *(Osmerus eperlanus),* club tailed dragonfly and other aquatic invertebrates.	Crossed by project
Connah's Quay and Woodlands	Site of Special Scientific Interest (SSSI) 2498	Population of great crested newt, assemblage of widespread amphibian species and its semi-natural broadleaved woodland.	2 km southwest
Deeside and Buckley Newt sites	Special Area of Conservation (SAC)	Annex 1 species - Old sessile oak woods. Annex 2 species - great crested newt.	2 km west
Buckley Claypits and Commons	Site of Special Scientific Interest (SSSI) 2592	Population of great crested newt, assemblage of widespread amphibian species and for its mosaic of semi-natural grassland.	2 km southwest
Gathering grounds and grounds woods & Llwyni pond.	Local Nature Reserve (LNR) (2641)	This 5-hectare reserve is nearly completely surrounded by housing development, but the pond is still a haven for great crested newts while the oak and ash trees provide cover for bluebells, wood anemones and ramsons and the cuckoo flower and yellow rattle can be seen in the open grasslands.	2.7 km west
Shotton Lagoons and Reedbed	Site of Special Scientific Interest (SSSI) 1639	This SSSI supports a large and increasing population of breeding common terns and reedbeds important for locally uncommon breeding species such as reed warblers. Wildfowl from the nearby estuary use the site in winter and the site contributes therefore to the overall wintering waterfowl assemblage of the Dee Estuary.	3.4 km west
Inner Marsh Farm	Site of Special Scientific Interest (SSSI) - 1438	The site is notified for the ornithological interest it supports, particularly its wintering and summering bird populations.	4.8 km northwest

Site	Designation	Reason for notification	Proximity to Scheme[47]
Maes y Grug	Site of Special Scientific Interest (SSSI) 1423	Population of great crested newt.	>5 km west

8.4.3 A separate HRA Screening report has been produced which details those sites within the national site network screened in for further assessment as required under the Habitat Regulations. An Appropriate Assessment would be carried out to those sites screened in.

Non-statutory designated sites

8.4.4 Information on non-statutory designated Wildlife Sites within 2 km was obtained through desk study (Cofnod). Five sites were identified and are shown on **Figure 8.2,** Volume 2 of the ES and detailed in **Table 8-12.**

Table 8-12 Non-Statutory designated sites within the Scheme area

Site	Designation	Reason for notification	Proximity to Scheme[48]
The River Dee	Wildlife Site (36NW01)	Coastal and floodplain grazing marsh, coastal saltmarsh, mudflats, ornithological interest.	420 m northwest
Aston Wetland	Wildlife Site (36NW02)	Level triangular site of willow scrub with marshy grassland mosaic with patches of tall herb fern and birch trees along the railway. Floristically species rich.	1.48 km southwest
Sea View Wetland	Wildlife Site (26NE11)	Wetland with stands of common reed, great willowherb, bare ground (where disturbance has occurred) and a marshy grassland. Floristically species rich.	1.60 km west
Engineer Park	Wildlife Site (36NW05)	Pasture / meadow and scrub.	1.80 km east
Wepre Wood	Wildlife Site (26NE12)	Broad-leaved woodland and scrub.	1.89 km east

[48] As taken from the center of the existing bridge

Marine habitats

8.4.5 The intertidal habitats recorded within the site and adjacent areas are described in the intertidal survey report and covered in Chapter 16 Marine Environment, a summary is provided in the following paragraphs.

Saltmarsh dense / Continuous (H2.6)

8.4.6 Saltmarsh occurs in a narrow and clearly defined strip along both sides of the River Dee. The steeply sloping sea wall has truncated this strip of vegetation so that the gradation from saltmarsh to maritime grassland is very abrupt, in the distance of little more than a metre. Few of these communities are clearly defined, but species representative of them occur.

8.4.7 The northern bank of the River Dee is dominated by the presence of sea purslane (*Halimione portulacoides*) bordering the intertidal zone, followed by common saltmarsh-grass (*Puccinellia maritima*) which is interspersed with Babington's orache (*Atriplex glabriuscula*) and sea plantain (*Plantago maritima*). This is bordered from above by common couch (*Elytrigia repens*) or sea couch (*E. atherica*) (or a hybrid of the two) interspersed with sea aster (*Aster tripolium*) and sea beet (*Beta vulgaris subsp. Maritima*). Mown semi-improved neutral grassland borders this upper saltmarsh.

8.4.8 The southern bank has a less-defined zonation than the northern bank. Common saltmarsh-grass and Babington's orache border the intertidal zone, followed by common couch or sea couch (or a hybrid of the two) interspersed with sea aster and sea beet. Scattered sea purslane, sea aster, sea beet and Babington's orache were observed around the Queensferry Drain outflow, drainage gully, derelict boat hull and either side of the Dee Bridge. A single glasswort *Salicornia* spp. was found at the edge of the upper intertidal zone east of the Dee Bridge (GR SJ 32707 68326) (Target Note 5, **Figure 8.3B**).

8.4.9 At the location of the proposed new bridge, the northern bank of the River Dee is dominated by tall common or sea Couch (or a hybrid of the two), with abundant sea purslane dominating towards the lower saltmarsh zone with intertidal mud below that. The southern bank and the Queensferry Drain outflow

are dominated by scrub and intertidal mud, with scattered saltmarsh species in between.

Tidal River Dee

8.4.10 At the location of the proposed bridge, the River Dee is designated as a SSSI and SAC (River Dee and Bala Lake SAC). This section of the River Dee is canalised, set within a predominantly agricultural and industrial setting and is tidal and is heavily silted with no evidence of emergent / submerged vegetation. The strong tidal currents of the Dee transport and deposit sediment upstream of the bridge. Further information on the River Dee is provided in Chapter 7 (Road Drainage and Water Environment) and the Chapter 16 (Marine Environment).

Terrestrial habitats

8.4.11 The terrestrial habitats recorded within the site and adjacent areas are described in the following paragraphs. The location and extent of habitats present are shown on **Figures 8.3A – 8.1F**. The main terrestrial habitats identified (and associated JNCC Phase 1 Category Codes) were:

a) Woodland broadleaved plantation A1.1.2;
b) Woodland – Mixed plantation A1.3.2;
c) Scrub dense and continuous A2.1 and scattered A2.2;
d) Parkland / scattered trees – broadleaved A3.1;
e) Neutral grassland – semi-improved B2.2;
f) Improved grassland B4;
g) Tall herb and fern – tall ruderal C3.1;
h) Marginal and inundation – inundation vegetation F2.2;
i) Running water G2;
j) Cultivated disturbed land – arable J1.1;
k) Cultivated disturbed land – introduced shrub J1.4;
l) Boundaries – hedge intact species poor J2.1.2;
m) Built up areas – building J3.6 and caravan site J3.4;
n) Bare ground J4;

o) Standing water G1.

Woodland broadleaved plantation (A1.1.2) and woodland mixed plantation (A1.3.2)

8.4.12 Broadleaved woodland and mixed plantation woodland occurs along the majority of the survey area, mainly associated with planting for screening adjacent to the A494, the Flintshire Depot and along the railway embankment. Species noted along the railway embankment to the south and north include crab apple (*Malus sylvestris*), hawthorn (*Crataegus monogyna*), sycamore (*Acer pseudoplatanus*) and silver birch (*Betula pendula*).

8.4.13 Tree planting located either side of the A494 to the west side of the bridge include Lombardy poplar (*Populus nigra 'Italica')*, hybrid black poplar (*Populus x canadensis*), Norway maple (*Acer platanoides*) and sycamore. These species also occur within other areas of tree planting adjacent to the A494.

8.4.14 Arboricultural survey reports have been produced and are provided in **Appendix 8A**, Volume 2.

Scrub dense and continuous and scattered (A2.1, A2.2)

8.4.15 Scrub occurs in several locations within the survey area, mainly associated with unmanaged areas located to the rear of 'Makro', around the industrial areas to the west of the River Dee, within land associated with the wastewater treatment works and the Queensferry Drain. The dominant species include hawthorn and bramble (*Rubus fruticosus agg*). There are dense stands of the problematic species buddleia (*Buddleja davidii*) associated with an area of land adjacent to the scrap yard (Target Note 8 on the Phase 1 Habitat Plan, **Figure 8.3B**). This area may be subject to regular disturbance as horses are retained there, and during the survey period (2018-2024) these areas have been subject to some clearance.

Parkland scattered broadleaved trees (A3.1)

8.4.16 Broadleaved trees form the landscape planting and screening across the surveyed areas. A line of planted trees occurs adjacent to the north side A494 to the east of the River Dee. The tree planting is fairly mature and continuous and consists of hawthorn, elder (*Sambucus nigra*), purple-leaved filbert (*Corylus maxima*) 'Purpurea', hazel (*Corylus avellana*), dogwood (*Cornus sanguinea*), field maple (*Acer campestre*), sessile oak (*Quercus petraea*), rowan (*Sorbus aucuparia*), cherry (*Prunus* spp.*)*, sycamore (*Acer pseudoplatanus*), ash (*Fraxinus excelsior*) and guelder rose (*Viburnum opulus*).

8.4.17 Mature tree planting acting as screening to the wastewater treatment works includes a line of mature hybrid black poplar species which overhang the footpath located up from Chemistry Lane. These poplars are subject to a Tree Preservation Order (TPO). They are over-mature and often leaning in habit, many of them appear to be vulnerable to total collapse or branch loss and some trees were damaged during storms in 2022 and 2024.

8.4.18 Other tree planting across the surveyed sections is found in the open urban areas near the Queensferry interchange, the boundary of the former Flintshire CC Depot and adjacent to the Expressway Business Park.

Semi - Improved Neutral Grassland (B2.2) and Improved Grassland (B4)

8.4.19 The majority of the grassland habitat within the surveyed area consists of semi-improved neutral grassland. There is a long strip adjacent to the westbound carriageway of the A494 to the north-east of the River Dee. A section of this habitat is managed as a swale (Target Note 2) by NRW. The grassland was dominated by Yorkshire fog (*Holcus lanatus*), false oat-grass (*Arrhenatherum elatius*), cock's-foot (*Dactylis glomerata*), red fescue (*Festuca rubra*) with common spotted-orchid (*Dactylorhiza fuchsia*), meadow buttercup (*Ranunculus acris*), ribwort plantain (*Plantago lanceolate*), red clover (*Trifolium pratense*), dandelion (*Taraxacum agg*), creeping cinquefoil (*Potentilla reptans*), broad-leaved dock (*Rumex obtusifolius*), black medick (*Medicago lupulina*), white

clover (*Trifolium repens*), tufted vetch (*Vicia cracca*), common knapweed (*Centaurea nigra*) and yellow-rattle (*Rhinanthus minor*).

8.4.20 A strip of semi-improved neutral grassland continues along the tops of the banks of the River Dee, adjacent to the cycle path.

8.4.21 The area within the wastewater treatment works consists of a mosaic of habitats dominated by tall ruderal and scrub with scattered trees and managed areas of semi-improved neutral grassland around the settlement tanks and boundaries. Species noted within the semi-improved neutral grassland include common mouse ear (*Cerastium fontanum*), creeping cinquefoil, herb Robert (*Geranium robertum*), ribwort plantain, common field speedwell (*Veronica persica*), broad-leaved dock (*Rumex obtusifolius*), white clover, red campion (*Silene dioica*) and false oat-grass.

8.4.22 The area of grassland adjacent to the Queensferry Drain was similar in species composition to that which occurs in the wastewater treatment works, however it is subject to grazing pressure and trampling from ponies ('fly-grazing') and also regular maintenance by NRW.

8.4.23 There is an area of semi-improved neutral grassland associated with 'Makro' which surrounds the SuDS pond. This has been subject to management and sown with a meadow seed mix; some areas were left unmanaged with a taller sward height at the time of the survey. Species noted include perennial rye grass, Yorkshire fog, cock's-foot, ribwort plantain, common knapweed, creeping buttercup (*Ranunculus repens*) and broad-leaved dock.

8.4.24 Other areas of improved and semi-improved neutral grassland are associated with the landscape planting adjacent to the underpass and also the industrial estates, all of which are maintained as a short sward.

Tall herb and fern - tall ruderal (C3.1)

8.4.25 Tall ruderal vegetation lines the cycle path which runs east from Sealand Road to the River Dee. Species included great willowherb (*Epilobium hirsutum*), and common nettle (*Urtica dioica*).

8.4.26 Tall ruderal species are also dominant within the wastewater treatment works and adjacent to the Queensferry Drain. Species include common nettle, meadow sweet (*Filipendula ulmaria*), common hogweed (*Heracleum sphondylium*), creeping thistle (*Cirsium arvense*), mugwort (*Artemisia vulgaris*), rosebay willowherb (*Chamaenerion angustifolium*) hemlock (*Conium maculatum*) and teasel (*Dipsacus fullonum*). The areas of tall ruderal vegetation were dense and largely impenetrable within the wastewater treatment works. The Queensferry Drain is subject to yearly management, some areas within the wastewater treatment works have experienced clearance over the years.

Inundation vegetation (F2.2)

8.4.27 There is only one area of inundation vegetation within the study area. This occurs in an attenuation lagoon associated with the Makro retail unit (Target Note 13, **Figure 8.3A**). The lagoon (RMLP1) was created to accommodate storm water from the adjacent carpark and buildings. However, it was completely dry at the time of the survey conducted in 2018, with no evidence that it had recently held water. Dense stands of bulrush (*Typha latifolia*) have encroached, as well as willow (*Salix* spp.) scrub. During the additional surveys conducted in 2020, a small amount of water was present, but the 'lagoon' was dry again in 2022, 2023 and 2024.

Running water (G2)

8.4.28 The Queensferry Drain is located between the A494 and the wastewater treatment works (Target Note 6 **Figure 8.3B**). The southern end of the drain emerges as a canalised, concrete-sided drain from a long culvert beneath the Chester-Holyhead railway. The northern end of the drain enters a culvert below the track to the caravan park, leading to the NRW Queensferry Land Drainage Pumping Station (GR: SJ 3228 6846) and out into the River Dee.

8.4.29 The drain section between these culverts is approximately 260 m long. The banks of the drain comprise soft earth and boulders / stones. The bank profile is about 45^{o} either side of the drain, with a berm. Poaching of the ground on the eastern side of the drain is evident. The drain is approximately 2 m wide at the

invert, with less than 0.5 m water depth over a similar depth of silt. The flow is sluggish, discharging by gravity to the River Dee at low states of the tide. A tidal flap restricts tidal inflow but, during field surveys, water from the River Dee was observed to enter the drain at high tide.

8.4.30 A pumping station to the north of the drain operates to pump water to a higher-level outfall to the River Dee when levels rise during high tides. Further information on the Queensferry Drain is provided in Chapter 7.

Cultivated disturbed land – Arable (J1.1)

8.4.31 Arable land is present to the northeast of the Scheme, adjacent to the cycle path as well as in the wider floodplain.

Cultivated Disturbed Land – Introduced shrub (J1.4)

8.4.32 A large stand of buddleia occurs within derelict land associated with the former scrap yard (Target Note 8, **Figure 8.3B**). The full extent could not be determined as access to this area was restricted. Some has encroached onto land within the adjacent scrap yard. However, in 2024 a large extent of material was fly tipped within the scrapyard, causing further disturbance.

Hedge intact species-poor (J2.1.2)

8.4.33 Hedgerows are few within the site survey area and are associated with boundaries along Foxes Lane, small sections adjacent to the cycle path and along Chester Road East. All of these are well maintained with a low species diversity, no 'important' hedgerows, as classified in accordance with the Hedgerow Regulations[49] criteria, occur within the survey area. Hedgerow/tree line species include hawthorn, elder, ivy (*Hedera helix*), bramble and leyland cypress (*Cupressocyparis x leylandii*).

[49] Available at The Hedgerow Regulations 1997 http://www.legislation.gov.uk/uksi/1997/1160/contents/made

Built up areas building (J3.6) and caravan site (J3.4)

8.4.34 Within the survey area, developed land consists of a number of individual and semi-detached residential properties, industrial units, the wastewater treatment works, pumping station, electricity substation and the Riverside Gypsy Traveller site.

Bare ground (J4) and spoil (I2.2)

8.4.35 There is an area of bare ground within the former scrap yard which has become colonised with scrub and been the subject of recent (2024) extensive fly tipping which FCC have now removed. Other areas of bare ground (not highlighted on the Phase 1 plan) are associated with the areas of hard standing, including roads, access tracks, footpaths, industrial estates, depots etc.

Standing water (G1)

8.4.36 In addition to the lagoon (RMLP1) as described in 8.4.27, six additional ponds were noted.

8.4.37 One of the ponds is located within the Scottish Power Complex (noted as RMLP6 on the pond plan, **Figure 8.4B**, as shown in Volume 2) and is within 226 m of the proposed 3 m wide shared use path from Chemistry Lane to the Riverside Gypsy Travellers site and construction compound. A further pond (noted as RMLP7 on the same figure) is within 160 m of RMLP6. This pond is within 365 m of the proposed shared use path from Chemistry Lane.

8.4.38 Other ponds included in the habitat appraisal include RMLP2, RMLP3, RMLP4, RMLP5 a large attenuation pond and the Queensferry Drain. The locations of these are provided on **Figures 8.4A** to **8.4C**, Volume 2 of the ES.

8.4.39 During the updated habitat appraisal conducted in 2022 ponds RMLP3, RMLP6 and RMLP5 were dry. During the habitat appraisal in 2022, RMLP1, RMLP3, RMLP5, RMLP6 and the Pentre Retail attenuation pond were all dry. Access was restricted to RMLP4, RMLP6 and RMLP7 in 2024, RMLP3 and RMLP5 were dry.

8.4.40 Further information and pond descriptions are provided in **Appendix 8C**, Volume 3.

Priority habitats

8.4.41 **Table 8-13** lists the habitats found within, and adjacent to, the Site and whether these habitats are listed as Priority Habitats in Section 7 of the Environment (Wales) Act 2016. A value for their ecological significance has also been assigned.

Table 8-13 Summary of habitats and value of resource importance (note: intertidal and subtidal habitats have been listed in Chapter 16: Marine Environment)

Habitat Ref	Habitat description	Priority Habitat	Value/justification
A1.1.2	Woodland broadleaved plantation	x	**Local**/ although not classified as a priority habitat, this habitat has been classified as of local significance due to its situation within a largely urban landscape as well as meeting other planning biodiversity objectives.
A2	Scrub	x	**Local/** although not classified as a priority habitat, this habitat has been classified as of local significance due to its situation within a largely urban landscape as well as meeting other planning biodiversity objectives.
A3.1	Parkland / scattered trees broadleaved	x	**Local**/ although not classified as a priority habitat, this habitat has been classified as of local significance due to its situation within a largely urban landscape as well as meeting other planning biodiversity objectives.
B2.2	Neutral grassland semi-improved	x	**Local/** although not classified as a priority habitat, this habitat has been classified as of local significance due to its situation within a largely urban landscape as well as meeting other planning biodiversity objectives.
B4	Improved grassland	x	**None/**scoped out of further assessment. Limited in its extent and not affected.
C3.1	Tall herb and fern – tall ruderal	x	**Local/** although not classified as a priority habitat, this habitat has been classified as of local significance due to its situation within a largely urban landscape as well as meeting other planning biodiversity objectives.
F2.2	Inundation vegetation	x	**Local**/ although not classified as a priority habitat, this habitat has been classified as of local significance due to its situation within a largely urban landscape, its potential function as a pond as well meeting other planning biodiversity objectives.

Habitat Ref	Habitat description	Priority Habitat	Value/justification
J1.1	Arable	x	**None/** scoped out of further assessment. Field margins were not diverse.
J1.4	Introduced shrub	x	**None /** Buddleia is a problematic species which needs to be controlled.
J2.1.2	Hedge intact species poor	✓	**Local**/ A hedgerow is defined as any boundary line of trees or shrubs over 20 m long and less than 5m wide, although this habitat in the surveyed area is limited.
J3	Built up areas	x	**None/** scoped out of further assessment. Structures with the potential to support bats are assessed under the species section.
J4	Bare ground	x	**None/** scoped out of further assessment.
I2.2	Spoil	x	**None/** scoped out of further assessment. Fly tipping on former FCC scrap yard
G1	Standing water - ponds	✓	**Local/** Only one pond is considered to be a Priority Habitat[50], this is owing to the positive record of GCN, a protected species. In general, the habitat quality of the pond is below average.

Protected and notable species

Notable flora

8.4.42 The desk study highlighted the presence of a section 7 species, slender hare's-ear (*Bupleurum tenuissimum*) located within brackish grasslands and the drained grazing marsh located 900 m due west, upstream of the replacement bridge.

8.4.43 No notable species were recorded during the terrestrial surveys.

Great crested newts and other amphibians

8.4.44 Five amphibian species have been recorded within 2.0 km of the Scheme area within the last ten years. These are palmate newt (*Lissotriton helveticus*), smooth newt (*Lissotriton vulgaris*), great crested newt (*Triturus cristatus*), the common toad (*Bufo bufo*) and common frog (*Rana temporaria*). The closest record is that of a great crested newt (GCN) which was discovered by RML in

[50] Available at Ponds (UK BAP Priority Habitat description) (jncc.gov.uk)

July 2020 during updated reptile surveys to inform the Scheme. The record was submitted to Cofnod.

8.4.45 Seven ponds have been assessed over the survey period, in terms of their suitability to support great crested newts, results ranged from poor to good, in terms of habitat suitability**. Table 8.14** provides the results of the Habitat Suitability Index (HSI).

8.4.46 Results of the eDNA surveys highlighted one pond (RMLP4) as positive for GCN. This pond is located within 500 m of the Scheme footprint but is outside of the 250 m buffer (RMLP4 is approximately 320 m from the nearest extent of the Scheme; **Figure 8.4B**). The pond deteriorated in 2022 and there was no access to survey in 2024. A survey in 2025 confirmed that this pond remains eDNA positive for GCN.

8.4.47 During updated reptile surveys conducted between July and August 2020, one great crested newt was discovered under artificial refugia (roofing felt) placed within an undisturbed area located at the back of the wastewater treatment works. The location is provided on **Figure 8.4B**, Volume 2 of the ES. Seven visits were made over the reptile survey period in 2020, 2022 and 2023, but GCN was only observed on the one occasion. The location where the GCN was discovered is within the Scheme footprint. This area has since been subject to clearance works in relation to improvements to the wastewater treatment facility, not as part of the present Scheme, and was subject to surveys and site supervision from other ecological consultants.

8.4.48 Within the Scheme and wider area (within 500 m) there is a lack of suitable confirmed breeding habitat and potential ‘source’ ponds.

8.4.49 The nearest designated sites which support populations of GCN are located 2 km to the west of the A494 (Deeside and Buckley Newt Sites Site of Special Scientific Interest (SAC) and Connah’s Quay and Woodlands Site of Special Scientific Interest (SSSI)) with little habitat continuity between these sites and the Scheme area.

8.4.50 Owing to the presence of designated sites of which GCN are a feature of interest, Flintshire is regarded as one of the strongholds of the great crested newt[51], though the area around Queensferry is not identified as an area of high value for GCN. However, as the presence of GCN was discovered within the Scheme footprint during the reptile presence/absence survey, and RMLP4 was positive for GCN eDNA, this species is considered to be of ***County*** significance.

8.4.51 Other amphibian species may be present within the Scheme as there is suitable habitat terrestrial within the Queensferry Drain, the wastewater treatment works (a single frog was observed) and along the railway embankments. Amphibians, in general, are considered to be of ***Local*** significance.

[51] K Haysom, D Driver, M Cartwright, J Wilkinson and J Foster. 2018. Great Crested Newt in Wales, with specific references to its long-term prospects and within its stronghold in North-East Wales. NRW Science Report Series. Report No: 259. pp 113, Natural Resources Wales, Bangor

Table 8-14 HSI Score[52]

SI Number	SI Description	RMLP1	RMLP 2a	RMLP2	RMLP4	RMLP6	RMLP7
1	Geographic location	1.0	1.0	1.0	1.0	1.0	1.0
2	Pond area	0.9	0.7	1.0	1.0	0.95	0.4
3	Pond permanence	0.1	0.1	0.9	0.9	0.1	0.9
4	Water quality	0.01	0.01	0.67	1.0	0.01	0.67
5	Shade	1.0	1.0	1.0	1.0	1.0	1.0
6	Waterfowl effect	0.67	0.01	0.01	0.67	0.01	0.67
7	Fish presence	1.0	1.0	1.0	0.67	1.0	0.67
8	Pond density (ponds within 1 km)	0.8	0.85	0.95	0.67	0.85	0.67
9	Terrestrial habitat	0.67	0.67	0.67	0.33	0.67	0.67
10	Macrophyte cover	1.0	0.3	0.6	0.9	0.4	0.4
	HSI SCORE	0.45	0.26	0.54	0.78	0.27	0.67
	Suitability	**Poor**	**Poor**	**Below average**	**Good**	**Poor**	**Average**

8.4.52 Ponds RMLP3 and RMLP5 were not included since both were dry as of 2025. Queensferry Drain was scoped out of consideration for GCN as it is brackish and tidal.

[52] Results shown are from the 20th May 2025 survey.

Badger

8.4.53 Six records of badger activity were returned from the data search and a request was made to the Clwyd Badger Group during the desk study. The closest record is approximately 150 m from the Scheme. Other records are 1.3 km from the Scheme. During the updated desk study, a further five records were returned, all but one of these was a road casualty. The nearest record was over 600 m from the Scheme.

8.4.54 A total of four setts have been recorded during surveys conducted between 2018 – 2024 as well as foraging and movement activity, no latrines have been recorded. Badger activity was captured on numerous occasions on the camera trap by animals utilising a mammal path which leads from the railway line under the fence into the wastewater treatment works. The setts are single outliers, which are partially used or disused.

8.4.55 All land within the wastewater treatment works and adjacent to the wastewater treatment works, including the Queensferry drain, is considered to be part of the resident badger clan's territory and foraging / commuting habitat. Badgers would also utilise the habitat along the railway network to disperse into the wider habitat.

8.4.56 As badger sett records are considered to be sensitive, they have not been provided on a figure for submission with this report. Those with a legitimate need for information can request it and it will be supplied as additional confidential information.

8.4.57 Badgers are afforded protection under the Protection of Badgers Act; this protection is mainly concerned with welfare and preventing cruelty rather than conservation. The setts are located in close proximity to the main Scheme works area. All setts are located within 30 m of the footpath located between the railway line embankment and wastewater treatment works, any improvements here would need to consider the effects upon badgers.

8.4.58 Badgers utilise land within the wastewater treatment works, railway line and the Queensferry Drain as well as habitat along the Dee embankments, for foraging. Badgers are therefore considered to be of ***Local*** significance.

Otter

8.4.59 The desk study found two recorded field signs for otter within 2 km of the Scheme within the last ten years, this includes evidence of roadkill. The closest was within 1.3 km, a spraint noted on a bank by a culvert of Shotwick Brook. The Brook appears to have no real visible (from google earth) open connection to the River Dee which indicates either movement across land or via the culvert pipe (if sufficiently large enough). A further field sign (spraint) was noted further inland, along the same brook, on a ledge beneath a culvert, indicating that otters were quite likely on route to the lagoons to forage.

8.4.60 Previous monitoring surveys for otters in Wales showed a continued trend of recovery for the otter[53]. However updated monitoring surveys conducted by NRW, Cardiff University and volunteers using the same methods showed a substantive decline in their populations for the first time since the 1970s, from around 90% occupancy in 2010 to 70% in 2015 to 2018[54].

8.4.61 In North Wales the otter has continued to consolidate its range and is now widespread in the hydrometric areas of Glaslyn / Lleyn, Conwy / Clwyd and Dee. Recent monitoring of the Dee highlighted a 9% decline in the number of sites where otter signs were found since the last survey in 2009-10 but this was not a statistically significant decline and that the change is within what could be considered normal variation rather than a real decline. Otters are a secondary feature of interest of the designated SAC but are known to breed throughout

[53] NRW (2015) Otter Survey of Wales 2009 – 2010. https://naturalresources.wales/media/4590/osw-5-english-24-06-2015.pdf
[54] Kean EF, and Chadwick EA 2021. Otter Survey of Wales 2015-2018. NRW Report No: 519, NRW Available at https://cdn.cyfoethnaturiol.cymru/694539/osw-6th-report-final.pdf [Accessed 28/02/25].

the SAC and so maintain favourable conservation status with population and range trending upwards[55].

8.4.62 Evidence of otters has previously been found along the River Dee during surveys including feeding remains, spraint and footprints (**Figure 8.8**, Volume 2). However, suitable secure breeding sites are absent from the Scheme footprint although there are suitable rest-up areas within trees and scrub. No evidence of otters was recorded from the camera trap. Otters are considered to be of ***National*** significance.

Water voles

8.4.63 The desk study found one record for water vole from within 2 km of the Scheme in the last ten years. Feeding remains, droppings, latrines and a small number of burrows were recorded in 2024 on Shotwick Brook located 1.3 km from the Scheme. Surveys conducted as part of the development proposals for the Northern Gateway identified water vole field signs in the Garden City drain on the opposite side of the River Dee (northern side).

8.4.64 Surveys conducted in 2018 identified Queensferry Drain as having suitable habitat for water voles, though this has deteriorated over the years. No field signs have been recorded during surveys conducted to date, although numerous field signs for the brown rat were recorded. A dropping sample was collected on 04/09/2018 for further confirmation, the results received confirmed that the dropping sample was from a brown rat, with 99% sequence similarity. There was evidence of feeding signs from bank vole (*Myodes glareolus*) and this species was also recorded under the reptile refugia placed in the adjacent habitat.

8.4.65 During surveys conducted in 2022, water vole prints were noted within the mud on the south bank of the river Dee underneath the A494 bridge (**Figure 8.8**, Volume 2). It is likely that this on passage as no suitable burrowing habitat

[55] Mathews F, Smith B, Harrower C, Coomber F in association with the Wales Mammal Biodiversity Action Forum. (2020). The State of Mammals in Wales. A report by the Mammal Society for Natural Resources Wales, produced in association with Wales Mammal Biodiversity Action Forum. The Mammal Society, London. ISBN: 978-0-9935673-6-0 [Accessed 28/02/25].

occurs within the surveyed sections. The habitat at the bridge is not suitable for water voles owing to a lack of cover, burrowing habitat and the tidal influences of the Dee.

8.4.66 The water vole is a protected species and studies show that the estimate of population size in Wales is 89% smaller than in the 1995 Mammal Review (Mathews, F. *et al*). Surveys conducted to date show that they are absent from the Queensferry Drain, though some evidence was noted along the River Dee during surveys in 2022. Water voles are considered to be of ***Local*** significance.

Ornithology - terrestrial breeding birds

8.4.67 Surveys within the ZoI of the River Dee Bridge Replacement Scheme were carried out in 2021 and 2023. Surveys for 2025 have been conducted and reporting is currently underway.

8.4.68 Detailed survey reports are provided in **Appendix 8B**, Volume 3 of the ES.

8.4.69 Marine ornithology (covering waterfowl and waders including terns and diving birds) is discussed in more detail within the Chapter 16, Marine Ecology.

Survey results 2021

8.4.70 A total of 42 species were recorded during the breeding bird surveys conducted in 2021. Survey results with a full species list and map are provided in the report in **Appendix 8B**, Volume 3 of the ES. Observed notable species include the following:

a) One Schedule 1 species;
b) Eight Section 41 species;
c) Ten Section 7 species;
d) Eight Species on the Red List Birds of Conservation Concern (U.K.);
e) Twelve Species Amber List Birds of Conservation Concern (U.K.);
f) Ten Species on the Red List Birds of Conservation Concern (Wales); and
g) Fourteen Species on the Amber List Birds of Conservation Concern (Wales).

Surveys results 2023

8.4.71 A total of 64 species were recorded during breeding bird surveys, with 42 priority species comprising:

a) Two species listed under Schedule 1 of the Wildlife and Countryside Act 1981 (as amended);
b) 14 species listed under the Environment (Wales) Act Section 7;
c) One Rare Breeding Bird Panel species;
d) 14 species Red-listed by BoCC5;
e) 17 species Red-listed by BoCCW;
f) 20 species Amber-listed by BoCC5;
g) 14 species Amber-listed BoCCW;
h) Six species listed by IUCN2 as Endangered;
i) 12 species listed by IUCN2 as Vulnerable; and
j) Two Annex I species.

8.4.72 A total of 18 notable bird species (as defined by the BTO Data Report) were recorded during the surveys.

Surveys results 2025

8.4.73 Surveys for the 2025 season have been completed across all suitable habitats within the study area and the final technical report is currently in preparation. While no significant departures from previously established baseline trends have been noted to date, the complete results, including species lists, maps, and any notable records, together with a detailed description of the survey methodology, will be set out in the forthcoming report. This report will be provided as an appendix to the Environmental Statement once it has been formally issued and reviewed.

Summary of results and resource importance – Replacement bridge ZoI

8.4.74 The survey area supports several bird species of conservation concern. However, many species appeared to be in relatively lower numbers within the Scheme footprint compared to the surrounding areas and beyond the zone of influence extent. This is likely attributable to current levels of anthropogenic disturbance from roads, footpaths, cycle paths, a shooting range and industrial activity within the Scheme footprint.

8.4.75 The relative abundance of most species appeared to be stable or increasing, except for some, such as woodpigeon, magpie, house martin and swift, for which the BTO Data Report showed declining trends in the vicinity compared to their overall populations in Wales.

8.4.76 The desk and field data also indicated the significance of the habitats within the zone of influence, which could be important for the populations of several species. These habitats would be protected by appropriate mitigation and enhancement measures. The following habitats and features within the zone of influence have been identified as valuable to breeding birds:

8.4.77 The scrub and semi-improved neutral grasslands (scattered trees) along the A494 and proposed access roads support nesting bird species such as woodpigeon, collared dove, chiffchaff, blackcap, whitethroat, grasshopper warbler, finch species and other typically widespread passerines such as common tit and thrush species. Several goldfinch, common whitethroat and thrush species nests were identified in these habitats.

8.4.78 The residential properties surrounding the River Dee attract moderate numbers of house sparrow, starling, tit, pigeon, dove, thrush, finch and corvid species due to supplementary feeding and suitable nesting features within buildings and garden boundaries. House sparrow, starling and tit species were commonly observed entering small spaces and gaps within buildings.

8.4.79 The farmland surrounding the Scheme footprint, particularly within the south-east area, appears to support foraging corvid, pigeon, dove and gull species.

Skylark and lapwing were observed and heard during April but were not recorded thereafter. This is likely due to the rapid growth of the crop (oilseed rape). Breeding skylarks were noted to the northwest, outside the zone of influence. The farmland to the north currently has ongoing development (housing) which attracted two pairs of ringed plover. This species was also observed foraging along the riverbanks.

8.4.80 The mature trees, small copses, farmland and grasslands within the survey area could potentially support hobby, although only one observation of this species (in flight) was made. It is also likely that the surrounding area supports owl species such as barn owl, little owl and tawny owl. A barn owl was recorded during bat surveys flying due east to west, adjacent to the tree line and arable field to the north of the Dee.

8.4.81 The wastewater treatment works was identified as an important foraging area for swifts, swallows and house martins. Although access to this area was limited, birds could be seen in numbers of 50+ foraging in the area.

8.4.82 Based on survey results to date, it is estimated that the likely maximum importance value for conservation is at the ***county level***.

Ornithology – Terrestrial overwintering birds

8.4.83 Surveys within the ZoI of the River Dee Bridge Replacement Scheme were carried out in 2018-2019, 2020-2021, 2022-2023 and 2024-2025.

8.4.84 Detailed survey reports are provided in **Appendix 8B**, Volume 3 of the ES.

8.4.85 Marine ornithology (covering waterfowl and waders including terns and diving birds) is discussed in more detail within Marine Ecology, Chapter 16.

Survey results 2018-2019

8.4.86 Two Schedule 1 species were identified during these surveys. One Fieldfare was detected feeding in a field 700 m west central of the works at grid reference SJ316686. Three Redwings were heard, then seen, feeding in trees

and small shrubs on the edge of Welsh Road, approximately 250 m west, central of the works (SJ321686).

8.4.87 A total of five bird species of Principal Importance (Wales) were recorded during the three surveys conducted in 2018-2019. A large number of Black-headed gulls were noted on all surveys. Herring gulls were distributed well across the site extent on all surveys and were rarely identified in large flocks like the black-headed gulls encountered during the scope. One Kestrel was identified hunting in the field located east of the proposed works, approximately 100 m away at grid reference SJ325685. Lapwings were identified on all surveys; however, they were present in greater numbers during December and January. Two skylarks were detected via sight during February's survey; however more were heard singing but not seen. All individuals were heard and seen in the field located 200 m east of the proposed works, which is typical habitat for this species. Grid reference: SJ326685.

8.4.88 Seven amber listed species were noted and a total of eleven green listed species were identified throughout the wintering bird surveys.

Survey results 2020-2021

8.4.89 A total of 46 species were recorded during these surveys. Records of notable species include the following:

a) Three Schedule 1 species;
b) Six SPA species;
c) Seven Section 41 species;
d) Ten Section 7 species;
e) Nine Species on the Red List Birds of Conservation Concern (U.K.);
f) Eighteen Species Amber List Birds of Conservation Concern (U.K.);
g) Twelve Species on the Red List Birds of Conservation Concern (Wales); and
h) Thirteen Species on the Amber List Birds of Conservation Concern (Wales)

8.4.90 The areas in which the highest numbers of observations were made correspond with the areas in which the greatest number of species and the

highest abundance was recorded. Species richness across the total survey area was considered to be at a ***local*** level based on Fullers (1980)[56] species richness criteria, however there were distinct areas in which species did concentrate and appeared to be of more value than others. These notable areas include the following (including the distance from the Scheme footprint):

a) Running watercourse (River Dee) (0 m);
b) Rocky embankments exposed during low tide (220 m);
c) Riverbanks (0 m); and
d) Arable land, north-west of the A494 bridge (50 m).

Survey results 2022-2023

8.4.91 A total of 59 species were recorded during winter bird surveys between November 2022 and February 2023. Of the 59 species recorded, 30 species were listed under at least one legal or conservation designation. This assemblage holds importance at the ***county level*** for conservation, which is an increase from the results in 2020-2021. These comprised:

a) Two species listed on Schedule 1 of the 1981 Act;
b) 12 species listed in Section 7;
c) 10 ‘Red Listed’ species of Conservation Concern (BoCC5);
d) 17 ‘Amber Listed’ species of Conservation Concern (BoCC5);
e) Three UK Rare Breeding Bird Panel species; and
f) One European Birds Directive Annexe 1 species

8.4.92 Section 7 species (like dunnock, black-headed gull, bullfinch, herring gull, house sparrow, song thrush, starling, kestrel, and lapwing), Red List species (such as goldcrest, greenfinch, rook, lesser black-backed gull, meadow pipit, and common redshank), and Amber List species (including grey wagtail, mistle thrush, chaffinch, coot, grey heron, magpie, common sandpiper, great black-backed gull, greylag goose, oystercatcher, snipe, teal, and fieldfare) were noted in low to moderate numbers across the survey area and it is considered that

[56] Fuller, R., 1980. A method for assessing the ornithological interest of sites for conservation. Biological Conservation, 17. pp. 229-239

more suitable and higher quality habitats are available beyond the extent of the Scheme survey area.

8.4.93 Important habitat areas identified within the Scheme survey area for overwintering birds include:

a) Tree lines, hedgerows and scrub;
b) Grassland and arable land;
c) River Dee corridor;
d) Residential and commercial properties; and
e) Rocky embankments

Survey results 2024 – 2025

8.4.94 Surveys for the 2024 / 2025 season have been completed across all suitable habitats within the study area and the final technical report is currently in preparation. While no significant departures from previously established baseline trends have been noted to date, the complete results, including species lists, maps, and any notable records, together with a detailed description of the survey methodology, will be set out in the forthcoming report. This report will be provided as an appendix to the Environmental Statement once it has been formally issued and reviewed.

Summary of results and resource importance

8.4.95 Surveys conducted in the winters of 2018/2019 to 2024/2025 highlight how the areas affected by the Scheme are utilised by over-wintering bird assemblages which are a feature of interest of the SPA/Ramsar sites as well as other notable species.

8.4.96 The Dee Estuary Ramsar/SPA sites supports internationally important populations of a number of species. The proposed new bridge is located 1.0km from these sites. However, birds are mobile and so will utilise other areas along the River Dee. These areas include the intertidal habitats (for loafing, roosting, foraging and refuge) and adjacent fields and sand bars (for high tide refuge,

depending on food availability and the state of the tide). For detailed consideration on these areas see Chapter 16.

8.4.97 The residential properties within the Scheme footprint contain a typical selection of passerines associated with domestic gardens. Such species are likely to benefit from the presence of lawns and shrubs for foraging, roosting and breeding opportunities as well as predictable anthropogenic food subsidies.

8.4.98 Survey results gathered between 2018 – 2025 estimated maximum importance value was at the ***county level*** for conservation.

Reptiles

8.4.99 Records of reptiles were returned during the desk study conducted in 2018, 2020, 2022 and 2024. The closest was for common lizard (*Zootoca vivipara*) located 290 m due west near to Deeside Leisure Centre. A grass snake (*Natrix natrix*) was recorded 560 m due west near to Hurlbutts Drive.

8.4.100 Presence / absence surveys were conducted in 2018, 2020, 2022 and 2023. Surveys focused on suitable land within the wastewater treatment works, the Queensferry Drain, a former scrap yard located to the north of the wastewater treatment works and adjacent to the Riverside Gypsy Travellers site and along the footpath leading north from Chemistry Lane. No reptiles were recorded.

8.4.101 The locations of reptile refugia are provided on **Figure 8.6**, Volume 2 of the ES.

8.4.102 No reptiles have been observed during any of the surveys, although records occur within the wider area. Reptiles are therefore considered to be of ***Local*** significance.

Bats

8.4.103 Three species of bat were recorded within 2.0 km of the Scheme area within the last ten years during the desk studies. These are the common pipistrelle (*Pipistrellus pipistrellus*), brown long-eared bat (*Plecotus auritus)* and Whiskered / Brandt's Bat (*Myotis mystacinus/brandtii agg*). The closest of these records is that of a roost (common pipistrelle and brown long-eared bat) which

is located 339 m to the north of the Scheme at RAF Sealand. Since then, survey data obtained from updated surveys conducted as part of this Scheme have been submitted to Cofnod. Taking this into consideration, additional species recorded are Myotis species, noctule (*Nyctalus noctula*), soprano pipistrelle (*Pipistrellus pygmaeus*) and lesser horseshoe bat (*Rhinolophus hipposideros*).

Survey results 2018 - 2024

8.4.104 Results of bat surveys conducted to date are presented in **Tables 1** to **17**, **Appendix 8C**, Volume 3 of the ES. The following paragraphs set out a summary of the results over the survey period.

8.4.105 The bat transect surveys conducted between 2018 to 2024 identified the following species: noctule, soprano pipistrelle, common pipistrelle, *Myotis* species and Whiskered/Brandts. The majority of activity was from common and soprano pipistrelle.

8.4.106 Most bat activity recorded to date occurred on the footpath that runs north from Chemistry Lane beside the wastewater-treatment works. Foraging and possible commuting were also noted along the tree line that leads from the pumping station up to the River Dee, close to the terraced houses on Chester Road East and the Flintshire depot. Further activity was observed on the cycle path east of the River Dee between Fox's Lane and the river. At the A494 crossing, surveyors detected only common and soprano pipistrelle bats. No bats were seen crossing the River Dee during any of the transect surveys.

8.4.107 During the bat emergence / return to roost surveys conducted between 2018 to 2024, the following species were recorded: common and soprano pipistrelle, noctule, *Myotis* spp. and Whiskered / Brandt's. Again, the majority of activity was of the common pipistrelle, associated with the landscape planting to the west of the electricity substation and the gardens of the properties on Chester Road East.

8.4.108 One roost was identified during the emergence / return to roost surveys in 2018. A single common pipistrelle bat was noted emerging and also returning to

the roost within 3 Chester Road East (terrace property). It emerged and flew from the rear of the property near to the roof line. No bats were seen to emerge from the same properties along Chester Road East during the updated surveys in 2020. During updated surveys conducted in 2022, three bats were seen to emerge from the eaves of 3 Chester Road East, and 1 from under boarding placed across a window. No bats were seen to emerge during surveys conducted in 2024. The status of the roost is either a transitional / occasional roost or summer roost used by males and/or non-breeding females.

8.4.109 During surveys conducted in 2020 a single common pipistrelle bat was noted emerging from the electricity substation located adjacent to NRW Queensferry pumping station. A further two surveys were conducted in 2020, no bats were seen to emerge or return to roost during these further visits. No bats were seen to emerge during surveys conducted in 2022 or 2024 (three surveys conducted each survey period). In common with the roost classification of 3 Chester Road East, the roost has been classified as an occasional day roost used on an ad-hoc basis by pipistrelle bats (most likely males or non-breeding females).

8.4.110 The static detectors deployed between 2018 – 2024 identified eight species of bat within the Scheme area, including the common and soprano pipistrelle, whiskered / Brandt's, noctule, natterers, Daubenton's (*Myotis Daubentonii)*, lesser horseshoe bat (*Rhinolophus hipposideros),* and brown long-eared bat (*Plecotus auratus*). As with the transect surveys, the majority of this activity was of the common and soprano pipistrelles either commuting or foraging around the habitats in which the static detectors were placed.

8.4.111 Two trees were identified as having moderate potential for bat roosts in 2018. Potential roost features were identified within two of the poplars located along the footpath leading north from Chemistry Lane. These trees were subject to an inspection and surveys in 2020; no bats were seen to emerge or evidence discovered. Following an updated Ground Level Tree Assessment (GLTA) conducted in 2022, 2023 and 2024, these trees were downgraded to low (PRF-I) owing to damage from earlier storms. No further surveys were conducted to trees.

8.4.112 The estimated current conservation status (in terms of populations) of each of the species identified to date has been obtained from several sources including Mathews, F., Kubasiewicz L.M., Gurnell J., Harrower C.A., McDonald R.A Shore R. F[57] and the Mammal Society, 2018[58] and The National Bat Monitoring Programme (NBMP) Annual Report 2023[59] and the State of Mammals in Wales[60].

8.4.113 Trends for Wales in the National Bat Monitoring Programme (NBMP) Annual Report 2023 indicate that the population of lesser horseshoe bats is considered to have increased in both the long-term (since 1999) and the short-term (since 2017). The State of Mammals in Wales (2020) report indicates that the species range for lesser horseshoe bats is circa 19,549 km^2, it also states an increasing northward spread, possibly reflecting changing climatic conditions with an upward trend in range. The population size for lesser horseshoe bat is estimated to be 30,900 with an upper limit of 44,100 and a lower limit of 22,000 again with an upward trend. It is stated that the current population estimate is more than three times greater than that suggested by the 1995 Review. This is partly because of underestimation in the earlier review, but there also appears to be a genuine range expansion and population size increase.

8.4.114 The NBMP Annual Report 2023 latest trends from the Roost Count survey in Wales shows a significant decline for the common and soprano pipistrelle. However, as they switch roosts frequently the Roost Count trend is not considered a reliable measure of population change for this species. As such, the population status of these species in Wales cannot be assessed. The State of Mammals in Wales (2020) notes the species range for common and soprano pipistrelles as circa 20,600 km^2. However, the trend in Range and Populations was data deficient. The population size for common pipistrelle is estimated to

[57] Mathews F, Kubasiewicz LM, Gurnell J, Harrower CA, McDonald RA, Shore RF. (2018) A Review of the Population and Conservation Status of British Mammals: Technical Summary. A report by the Mammal Society under contract to Natural England, Natural Resources Wales and Scottish Natural Heritage. Natural England, Peterborough.
[58] Mammal Society 2018, The Mammal Society's Guide to their Populations and Conservation Status
[59] Bat Conservation Trust, 2023. The National Bat Monitoring Programme Annual Report 2023. Bat Conservation Trust, London. Available at: https://cdn.bats.org.uk/NBMP-annual-report-2023. [Accessed 05/03/25].
[60] Mathews F, Smith B, Harrower C, Coomber F in association with the Wales Mammal Biodiversity Action Forum. (2020). The State of Mammals in Wales. A report by the Mammal Society for Natural Resources Wales, produced in association with Wales Mammal Biodiversity Action Forum. The Mammal Society, London. ISBN: 978-0-9935673-6-0.

be 297,000 with an upper limit of 732,000 and a lower limit of 96,600. For soprano pipistrelle, the estimated population size is 478,000 with an upper limit of 862,000 and a lower limit of 202,000. It is stated that the current population estimate is more than four times higher than that in the 1995 Review, but the historical estimate was extremely unreliable, so it is not possible to draw conclusions about trends in population size over time. The species is therefore classed as data deficient.

8.4.115 The NBMP Annual Report 2023 states that the population of the brown long-eared bat in Wales is considered to have been stable in the long-term (since 1999) and short-term (since 2017). The State of Mammals in Wales records the species range as 20,643 km^2. However, the trend in Range and Populations was data deficient. The population size is estimated to be 96,600 with an upper limit of 228,000 and a lower limit of 5,400.

8.4.116 The NBMP states that the population of Daubenton's bat in Wales is considered to have been stable since 1999 with an estimated population of 108,000 (plausible upper and lower limit of 466,000 and 2,860 respectively). The Populations of whiskered and Brandt's bat combined are considered to have been stable in Wales since 1999. The two species are uncommon but widely distributed in England and Wales. The population of Natterer's bat in Wales is considered to have increased since 1999. The population estimate in Wales is 52,000 (upper and lower limit of 332,000 and 1,900 respectively). The State of Mammals in Wales notes the species range for Daubenton’s as 20,377 km^2, Whiskered/Brandts as 20,488 km^2 and Natterers 20,611 km^2. However, the trend in Ranges and Populations was data deficient for all species except Daubenton’s, which is reported as stable.

8.4.117 The NBMP states that the survey indices for noctule produced in Great Britain and at a country level for England indicate that the population is stable. There is insufficient data to calculate population trends for this species in Wales.

Summary of results and resource importance

8.4.118 Foraging and commuting habitats on site which had the majority of activity included the tree line to the south of the wastewater treatment works, habitat within the wastewater treatment works and adjacent to Queensferry Drain. Very little activity was recorded adjacent or along the River Dee. In general, important habitats within a site context include tree lines, scrub, the drain, tall ruderal habitat and the River Dee.

8.4.119 Within the wider area, and within the respective Core Sustenance Zone (CSZ)[61] for bats known to be present on site (the maximum CSZ is for Noctule and Myotis species at 4 km) the main connecting feature and areas with the highest potential for dispersal are the existing tree lines and the river corridor.

8.4.120 The primary habitat feature for the lesser horseshoe bat (CSZ of 2 km) is broadleaved woodland and wooded riparian corridors, mature treelines and hedgerows. Brown long-eared bats (CSZ of 3 km) are associated with trees, particularly broadleaved, preferring woodland with a cluttered understorey, likewise for natterers, which also make use of tree-lined river corridors, trees in parkland, and hedgerows adjacent to pasture. Common and soprano pipistrelles forage over sympathetically managed grazed pasture and deciduous woodland. The soprano pipistrelle bat is frequently reported to make particular use of riparian habitat. Noctule (CSZ of 4 km) are found in a range of habitats foraging in the open or often over trees, pasture and water, while Daubenton's is a species with a strong association to water.

8.4.121 The two roosts identified to date are connected to the wider landscape by existing treelines.

8.4.122 **Table 8.15** outlines an approach which considers the importance of the bat assemblage of the site, based on survey data collected to date utilising an

[61] A core sustenance zone (CSZ), as applied to bats, refers to the area surrounding a communal bat roost within which habitat availability and quality will have a significant influence on the resilience and conservation status of the colony using the roost (source: BCT)

approach detailed in the Bat Mitigation Guidelines[62]. This is based on a theoretical maximum for north/mid Wales of: three widespread species (1 point per species - score 3), five less-abundant species (2 points per species - score 10), one rare species (3 point per species - score 3), and five very rare species (4 points per species score 20) producing a maximum total score of 36.

8.4.123 Utilising this scoring system, an overall site assemblage score of 14/36[63] = 38.8% was given, which does not meet the threshold for County importance, as such the bat assemblages at the site are considered to be of ***Local Importance***.

[62] Sections 3.4.26 -3.4.33 of Bat Mitigation Guidelines Reason, P.F. and Wray, S. (2023).
[63] Maximum possible threshold based on Table 3.3 of the Bat Mitigation Guidelines. Reason, P.F. and Wray, S. (2023)

Table 8-15 Assessment of the importance of bat assemblage at the site

Species and rarity category[64]	Importance of roosts[65]	Importance of commuting habitat	Importance of assemblage[66]
Widespread Common pipistrelle Soprano pipistrelle Brown long-eared bat	Previous surveys identified a common pipistrelle roost within #3 Terrace properties Chester Road East and a single common pipistrelle bat emerging from the electricity substation located adjacent to the pumping station. The roosts have been classified as occasional day roosts used on an ad-hoc basis by pipistrelle bats (most likely males or non-breeding females) and is of value within a **site context**. These buildings would be demolished, were the Scheme to go ahead.	The habitats combined in and around the redline boundary meet the definition of 'moderate' potential value as defined in Collins (2023)[67]. Taking all the above into account, the habitats within the site boundary are considered to be of **local importance.**	1 point per species **Score 3** for this part of the assemblage (of a maximum of 3)
Widespread in many geographies, but not as abundant in all Daubenton's bat Natterer's bat Noctule Whiskered/Brandt's	No roosts for these species have been recorded		2 points per species. **Score 8** for this part of the assemblage (of a maximum of 10)
Rarer or restricted – Lesser horseshoe bat	No roosts for these species have been recorded		3 points per species **Score 3** for this part of the assemblage (of a maximum of 3)
Rarest Annex 2 species and very rare	No roosts for these species have been recorded		4 points per species

[64] Based on Table 3.1 of the Bat Mitigation Guidelines Reason, P.F. and Wray, S. (2023)
[65] Based on Table 3.2 of the Bat Mitigation Guidelines. Reason, P.F. and Wray, S. (2023)
[66] Based on Table 3.3 of the Bat Mitigation Guidelines. Reason, P.F. and Wray, S. (2023)
[67] Based on Table 4.1 of Bat Surveys for Professional Ecologists. Collins, J. (ed.) (2023)

Species and rarity category[64]	**Importance of roosts**[65]	**Importance of commuting habitat**	**Importance of assemblage**[66]
n/a			**Score 0** for this part of the assemblage (of a maximum of 20)
Overall score: Assemblage score 14/36[68]. = 38.8%; does not meet the threshold for County importance. NB: Rarest Annex 2 species and very rare species as recorded in North/ mid Wales[69] (Greater horseshoe bat *Rhinolophus ferrumequinum;* Barbastelle *Barbastella barbastellus*; Serotine *Eptesicus serotinus;* Nathusius' pipistrelle *Pipistrellus nathusii;* Leisler's bat *Nyctalus leisleri)* have been excluded as they have not been recorded on site.			

[68] Maximum possible threshold based on Table 3.3 of the Bat Mitigation Guidelines. Reason, P.F. and Wray, S. (2023)
[69] Refer to Table 3.1 of the Bat Mitigation Guidelines. Reason, P.F. and Wray, S. (2023)

Invasive Non-native Species

8.4.124 Information on the locations of INNS was collected through a desk study and site surveys conducted between 2018 - 2024. The following species listed on Schedule 9 of the WCA and/or Regulation (EU) No. 1143/2014 were recorded during the desk study: Japanese knotweed (*Fallopia japonica*) highlighted within 118 m of the Scheme, giant hogweed (*Heracleum mantegazzianum*) located within 1706 m, montbretia (*Crocosmia pottsii x aurea = C. x crocosmiflora*) located within 1233 m and Himalayan balsam (*Impatiens glandulifera*) within 1351 m.

8.4.125 Large stands of Japanese knotweed were recorded during the Phase 1 habitat survey. These stands occur adjacent to the Chester to Holyhead railway line, close to the eastbound carriageway as shown on **Figure 8.3A**, Target Note 9 and Target Note 11.

8.4.126 A stand of giant hogweed (*Heracleum mantegazzianum*) occurred within plantation woodland adjacent to the footpath which heads under the A494 bridge crossing. This plant appears to have been treated with herbicide with no evidence of it being present in 2024.

Summary evaluation of ecological baseline

8.4.127 It is impractical for an assessment of the ecological effects of the Scheme to consider every species and habitat that would be affected; instead, it should focus on ‘Valued Ecological Receptors’ (VERs) based on their legal protection, designation, rarity etc and whether they are significantly affected by the Scheme.

8.4.128 Species and habitats which are considered to be widespread, not threatened and resilient to the Scheme effects, and which will remain viable and sustainable, have been scoped out of the assessment. However, where a species or habitat has been ‘scoped out’ consideration will still be given to safeguarding biodiversity in general in order to comply with relevant plans, policies and initiatives. For example, all habitats listed in **Table 8-13** which are not Priority habitats, but are of local importance, flora, water voles and reptiles

(due to lack of evidence in survey) and hedgehogs are not considered to be VERs but are considered important in terms of their biodiversity value and so general mitigation measures are recommended in **Section 8.5.**

8.4.129 **Table 8.19** provides a summary of the VERs identified through desk study and site visits and surveys, their assigned value and justification for inclusion.

Table 8-16 Summary of Valuable Ecological Receptors (VERS)

VER	Value (sensitivity)	Justification
Statutory Designated Sites		
River Dee and Bala Lake / SAC	**International**	No significant effects on the features of the Annex I habitats that are a primary reason for selection of this site are envisaged, as the habitat type supporting these communities does not occur at the location of the proposed Scheme. However, the SAC is considered to be of international / very high value due to the presence of migratory fish species Atlantic salmon and sea and river lamprey, and otter.
Habitats		
Running water	**International**	The River Dee is a priority habitat as well as being designated an SAC/SSSI.
Standing water	**Local**	Only one pond is considered to be classified as a Priority Habitat[70], this is owing to the positive record of GCN, a protected species. In general, the habitat quality of the pond is below average.
Hedge intact species poor	**Local**	This habitat in the surveyed area is limited.
Species (Fauna)		
Great Crested Newt	**Local**	A GCN was discovered within the Scheme footprint during the reptile presence/absence survey, and RMLP4 was positive for GCN eDNA. This area has been subject to disturbance in respect of improvements to the wastewater treatment works.
Other amphibians	**Local**	Suitable habitat within the Queensferry Drain, the wastewater treatment works and along railway embankments.
Badger	**Local**	Four active setts recorded adjacent to the Scheme footprint. Badgers utilise land within the wastewater treatment works, railway line, Queensferry Drain and Dee embankments for foraging.
Otter	**National**	Otters are a feature of interest of the River Dee and Bala Lake SAC which is crossed by the Scheme and evidence of otters has been found along the River Dee, however the suitability for natal dens is poor due to disturbance although there are suitable rest up sites within areas of trees and scrub. Otter populations show a general upward trend in the Dee catchment and so a value of National importance has been assigned.
Terrestrial breeding birds	**County**	Increased levels of disturbance from construction activities, artificial light, noise, vehicle movements, and site personnel, a reduction in the physical extent of available habitat for breeding, foraging, and commuting.
Terrestrial overwintering birds	**County**	loss and fragmentation of foraging habitat and increased levels of disturbance from construction activities, artificial light, noise, vehicle movements, and site personnel.
Bats	**Local**	All bats are afforded protection under current legislation and the surveys identified eight species of bats and two pipistrelle roosts. A local value is proportionate to the species and numbers encountered on site, habitat to be affected and roost status.

[70] Ponds (UK BAP Priority Habitat description) (jncc.gov.uk)

Future baseline conditions

8.4.130 Climate projections have been obtained for the Scheme location (25 km^2 grid cell in the UKCP18 projections: 337500, 362500 and grid cell in the UKCP18 marine projections: latitude(N): 53.39, longitude(E): -3.25) from the Met Office's UKCP18 User Interface. The data is presented and summarised in Chapter 15 of the ES.

8.4.131 Air temperature projections show an expected increase throughout the operational period of the Scheme. In the 2050s maximum temperatures in the summer are projected to increase by 2.2°C and minimum temperatures in the winter projected to increase by 1.5°C. In comparison, in the 2090s maximum temperatures in the summer are projected to increase by 5.5°C and minimum temperatures in the winter projected to increase by 3.4°C. This has the potential to result in warmer winters and hotter summers.

8.4.132 Precipitation projections show a changing pattern in the Scheme location throughout the operational period. In the 2090s precipitation in the summer is projected to decrease by 36.2% but projected to increase in the winter by 12.2%. This has the potential to result in drier summers and wetter winters. Extreme precipitation events in Wales may become more frequent and intense in the future[71]. During the summer months, despite there being an overall projected decrease in precipitation, intense rainfall events may be more severe in the form of summer storms.

8.4.133 Rapid, large changes in global temperatures (4˚C or more above the pre-industrial temperature by the end of this century) and changes in rainfall patterns will increase the vulnerability of many species to climate change. Even with smaller amounts of warming many species will be placed at greater risk. The animals and plants most at risk will be those that:

a) Have no new habitats to move to;

[71] Committee on Climate Change (2021). *CCRA3 – Regional Summary for Wales* [online]. Available at: https://www.ukclimaterisk.org/wp-content/uploads/2021/06/CCRA-Evidence-Report-Wales-Summary-Final.pdf [last accessed February 2023.

b) Can't move quickly to new habitats;

c) Are already under threat from other factors, such as habitat loss and degradation because of human activity.

8.4.134 There is the potential for change in the baseline conditions in the medium to long-term resulting from climate change. The Climate Change Risk Assessment for Wales CCRA3 (2021) identified the main potential effects to terrestrial and marine species and habitats to be:

a) Reduction in soil moisture and lower river flows and an increase in the frequency and magnitude of droughts;

b) Changes in soil organic carbon, although the ways in which it might be affected are not adequately understood at present;

c) Changes in species migration patterns which could result in significant changes to biodiversity;

d) Increases in pests and diseases;

e) Changes to coastal and estuarine habitats and species, including a reduction in intertidal area; and

f) Changes to the marine environment including an increase in disease hosts and pathogens, harmful algal blooms and invasive species.

8.4.135 The Climate Adaptation Strategy for Wales[72] states that the WG want nature and biodiversity to be protected. The WG approach to delivering climate resilience for nature has been set in legislation through the Environment (Wales) Act 2016, the objective being for public authorities to seek to maintain and enhance biodiversity, and in doing so promote the resilience of ecosystems and the benefits they provide. Resilient ecosystems may be defined as diverse, connected, of sufficient extent and in good ecological condition so that they can adapt to change and continue to provide benefits for future generations.

8.4.136 The main potential effects on the future baseline are the link with the coastal areas and sea level rise, species migration patterns including fish and migratory bird species, increases in INNS, stress to native species therefore

[72] Available at https://www.gov.wales/sites/default/files/publications/2024-10/climate-adaptation-strategy-for-wales-2024.pdf [Accessed 11/03/25]

decreasing resistance to the potential invasion of INNS, reduction in intertidal habitats including those which are a feature of the designated sites and important habitat for breeding and overwintering bird assemblages. Fish, including shellfish, could also be affected by an increase in water temperature and changes in water quality. There may also be implications on the status of the designated sites and degradation in ecological functionality. Rising temperatures can impact upon the Atlantic salmon and trout populations in the River Dee, leading to a range of ecological and biological challenges including thermal stress, reduced oxygen levels, disrupted life cycles and increased disease risk.

8.4.137 In grassland habitats reduced summer rainfall and increased evaporation and transpiration could affect species composition. Areas created as wetland / swale will have less input and become dry more often / for greater periods. The swale located at Target Note 2, **Figure 8.3C** as well as the SuDS pond at Target Note 13 were completely dry during the Phase 1 habitat surveys. In the future baseline these water features could be permanently dry outside extreme rainfall events.

8.4.138 Overall, climate change and the effects on the natural environment are hard to predict due to a range of interrelated factors, i.e., economic growth, new developments and technologies and the actions which the Welsh Government and key organisations are taking to minimise climate risks at present.

8.4.139 Examples of habitat restoration in Wales which aim to build resilience to climate change include projects that are part of the National Peatland Restoration Programme such as the upper Conwy catchment, lowland Mires project and other restoration, including of sand dunes, as well as compensatory saltmarsh creation through the National Habitat Creation Project.

8.4.140 Whilst in the long-term rising sea levels may cause a loss of intertidal habitats, the Climate Adaptation Strategy for Wales also highlights the expansion of salt marshes as a result of sea level rise and saltwater intrusion, which can have a positive impact on biodiversity in some areas.

8.4.141 Opportunities resulting from climate change will be taxonomy and species specific, with more mobile species likely to be more responsive. Climate change, especially increasing temperatures, can provide the opportunity for increases in populations as well as leading to species moving or expanding their ranges northwards.

8.4.142 In a general sense, it is considered that climate change will not influence the effects of the Scheme on biodiversity within the timescale of construction and opening of the replacement bridge. Chapter 15 concludes that overall, the vulnerability of the Schemes and receptors to climate change is anticipated to be not significant.

8.5 Mitigation Measures Forming Part of the Scheme Design

8.5.1 Mitigation has been considered as an intrinsic and iterative part of the Scheme design process. The 'mitigation hierarchy' of Avoid, Prevent, Reduce (mitigate) Offset (compensate) and Enhance has been adopted as part of the process. Following this guidance, the mitigation measures relevant to this assessment of the ecological effects of the Scheme are outlined in this section.

8.5.2 The Scheme would include standard measures to control pollution during construction and demolition, and these would be set out in the CEMP, **Appendix 18A**, with additional ecological related mitigation set out within Annex I of the CEMP (outline ecological management plan).

8.5.3 The CEMP would include provisions for pollution control measures including Natural Resources Wales Guidance for Pollution Prevention (GPP) 5[73]: Works and Maintenance in or near water. This would include mitigation of the effects of the potential accidental release of contaminated water into the marine environment and to control any discharge of contaminated runoff generated during the construction and demolitions phases of the Scheme. Any construction or demolition work would be carried out in accordance with

[73] Available at https://www.netregs.org.uk/media/1418/gpp-5-works-and-maintenance-in-or-near-water.pdf [Accessed 12/03/25]

Natural Resources Wales Guidance for Pollution Prevention (GPP) 6[74]: Working at Construction and Demolition Sites.

8.5.4 Pre-commencement site walkovers and surveys and specific Reasonable Avoidance Measures (RAMs) would be carried out. Site clearance would consider the seasonal environmental constraints.

8.5.5 Further surveys will be conducted, where required, as the Scheme progresses to confirm and/or maintain the validity of the baseline survey and to check areas of the site immediately before works are carried out.

8.5.6 The mitigation measures described below would, in most cases, be located within land included in the Draft Orders for the Scheme. Where this is not the case, and delivery would be by agreement, this is indicated. In some locations, because of constraints on permanent land take or due to the method of construction required, additional areas of land are needed temporarily to allow construction.

Avoid / Prevent

8.5.7 Measures to avoid adverse effects have been adopted as an intrinsic part of the design and are described in more detail in Chapter 2 ‘The Project’ and Chapter 3 ‘Alternatives Considered’. Chapter 3 details how the preferred option was selected due to its lower environmental footprint, while Chapter 2 outlines specific embedded mitigation, such as design choices for saltmarsh habitat and in-river works.

8.5.8 Reasonable Avoidance Measures would be used to protect otters, breeding birds, badgers, water voles, amphibians and reptiles. Where protected species or their habitats would be likely to be affected, the works would be carried out in accordance with the methods laid out in the CEMP or as set out in associated derogation licences and agreed with an ecologist. Reasonable Avoidance Measures would include:

[74] Available at https://www.netregs.org.uk/media/tsybv2y3/gpp6-working-on-construction-and-demolition-sites.pdf [Accessed 12/03/25]

a) The clearance of trees, shrubs and hedgerows, which would be undertaken outside the bird nesting season (typically March to August).

b) Stage strimming of any areas of vegetation with suitable habitat to displace mobile species before earthworks commence, in particular within the Queensferry Drain, areas adjacent to Makro, the wastewater treatment works and site compounds;

c) Fingertip search of vegetation to be removed;

d) Dismantling and hand-searching of suitable reptile refugia before full clearance;

e) Site supervision during de-watering works within the Queensferry Drain;

f) The demolition of buildings where bat roosts have been discovered would be timed to avoid the sensitive period for bats (i.e. winter hibernation); and

g) Maintain green corridors and the retention and protection of habitats which are being retained.

Reduce (mitigate)

8.5.9 Measures to prevent adverse effects include the following 'mitigation by design' which are integral to the Scheme:

a) Planting design which allows movement of species, i.e., linear habitats including hedgerows and tree planting which provide cover and shelter;

b) Sensitive design of lighting over the Dee and associated banks;

c) Minimise light spill along existing and proposed landscape planting;

d) Replacement open drains;

e) Landscape / habitat provision as shown on the Environmental Masterplan (EMP) **Figures 2.3A - D** including wildflower seeding and tree planting; and

f) Provision of bat roosts to replace those which are lost to the Scheme as shown on the Environmental Masterplan (EMP) **Figure 2.3A.**

8.5.10 Lighting will be designed to avoid any illumination beyond that which is required for health and safety. Lighting would be required on the main carriageway of the bridge and road corridor along the full length of the Scheme, depending on the outcome of a TA501 assessment.

8.5.11 For the bridge structure, lighting columns will be incorporated within the central reserve. The junction into Riverside Way off the westbound carriageway will also be lit.

8.5.12 The luminaires will be directional to reduce light spill and light trespass, ensuring the carriageway is illuminated for the health and safety of road users and cyclists using the shared use route on the southern side of the bridge. Additional supplementary lighting is required for some sections of the active travel route such as the section of the active travel route that passes under the bridge on the western riverbank. Here the lighting would be directional LED luminaires mounted on 6-metre high columns with low kilolumen output and a correlated colour temperature of 3000K. No lighting is proposed for the active travel route along the eastern riverbank.

8.5.13 In order to mitigate for the loss of a pipistrelle roost at 3 Chester Road East, roosts would be provided within land to the east of the main carriageway adjacent to the Makro pond, as shown on the Environmental Masterplan (**Figure 2.3A**). This location is adjacent to the existing roost.

8.5.14 The roost will consist of three, free-standing pole-mounted bat boxes (for example eco rocket box[75]) suitable for crevice-dwelling bats. The new pole-mounted bat roosts would be situated close to the existing Makro pond and proposed new drain and associated habitat features including a double hedge providing a link to the Chester to Holyhead railway embankment.

8.5.15 To mitigate for the loss of a pipistrelle roost at the electricity substation located adjacent to the NRW pumping station, a new roost would be created as shown on **Figure 2.3C**. The structure would be within 100 m of the roost to be destroyed. The new roost would consist of like for like construction; detailed design of the new roost would be submitted as part of the full licence application.

8.5.16 The existing roosts, and any others which may be found as the Scheme progresses, will be subject to further surveys and destroyed by demolition

[75] Available at https://www.nestbox.co.uk/products/eco-rocket-bat-box

under a licence obtained from Natural Resource Wales. The draft licences for these roosts have been discussed with NRW in advance of the decision on the Orders, to avoid delays when the formal application(s) are made. NRW confirmed by letter (ref ME/1.1.7.1 dated 15 December 2020) that for the demolition of the roost at 3 Chester Road East "*the proposal accords with the provisions of Article 16 of the Habitats Directive and associated licensing requirements under Regulation 55 of the Conservation of Habitats and Species Regulations 2017 (as amended). This view considers the outlined mitigation and compensation proposals together with requirements to appropriately maintain the ecological functionality of these features in the long term*".

8.5.17 Consultation with NRW in respect of the Ghost Licence for the demolition of the electricity sub-station has been conducted, and NRW have confirmed approval in principle of the methodologies set out within the licence. These licenses would need to be updated for resubmission to NRW.

Compensate

8.5.18 To offset for the permanent loss of the narrow strip of saltmarsh habitat along the riverbank, which will result from construction of the new bridge and demolition of the existing bridge, replacement habitat would be developed.

8.5.19 The study team considered the difficulty of creating new saltmarsh adjacent to the new crossing, something also highlighted by NRW, but concluded that the more effective approach would be to improve the condition of existing saltmarsh at Greenfield Marsh to offset that lost at the bridge location.

8.5.20 The proposed approach is considered in more detail in Chapter 16, Marine Environment and in the **Green Infrastructure Statement, Appendix 8E, Volume 3.**

Enhancement

8.5.21 A dark corridor would be established next to the shared use path between Foxes Lane and the River Dee, as shown on **Figure 2.3D**. Two new native hedgerows running parallel to the shared use path would provide shading to a

strip of grassland in between them, forming a 'dark corridor' to facilitate movement of species such as bats. This corridor would be established on land which is currently arable, as such it represents a biodiversity enhancement above what current exists.

Biosecurity

8.5.22 In order to minimise the potential effects of INNS, biosecurity measures designed to manage and control their spread would be a contractual requirement for construction and an outline is presented within the CEMP. In Summary, the following measures will be implemented, where possible:

a) Contractors to be made aware of INNS which may be encountered on site by way of 'toolbox' talks and posters;

b) Access and egress to the water body will be limited to a single point(s) when undertaking 'in river' work; and

c) Anything that comes in contact with the water, including boots, will be carefully cleaned.

8.6 Assessment of Land Take Effects

8.6.1 Along the main Scheme corridor, where possible, a working space from the edge of the earthworks to the highway boundary has been allowed for. There is generally a 3 m easement for the purpose of constructing and maintaining the fence line along the length of the Scheme. There will also be the requirement for temporary land take for the site compounds. Land would be required for the construction phase, to accommodate the in river works area.

8.6.2 In this section, the potential effects of land take on each of the VERs, as detailed within **Table 8-16**, are identified and assessed, first without mitigation and then with mitigation to determine the significance of residual effects. For the purposes of this assessment, the mitigation listed in Section 8.5 is considered to be an integral part of the Scheme.

Statutory designated sites and associated habitats

8.6.3 As rivers are a dynamic system, the effects of land take in terms of riverbed, are hard to estimate. A Hydrodynamic and Sediment Transport Modelling report has been produced and is provided as an Appendix to Chapter 7, Road Drainage and Water Environment. The effects from construction processes are assessed in Section 8.7 and the Marine Environment Chapter, further information on the project is provided in Chapter 2. Aquatic Ecology is considered as part of Chapter 7 in Appendix 7B, Volume 3: WFD Assessment.

Standing water (G1)

8.6.4 No ponds would be lost as part of the Scheme. ***Neutral effect*.**

Hedge intact species poor (J2.2.2) and linear tree belts

8.6.5 A small section of hedgerow may be lost to accommodate a culvert and cycle track to the west of the Scheme. Hedgerows are considered to be of local importance, however, only a very small area would be lost and as such the effect is considered to be ***slight adverse.*** Hedgerow planting would be created as part of the Scheme, to a greater extent than that which is lost, and this would result in a ***minor beneficial effect***, within a local context.

8.6.6 A section of linear tree belt would be lost, particularly along the northeast, to accommodate the realigned road prior to its route across the River Dee and also to the south of the realigned A494. The loss is considered a ***slight adverse*** effect in the short term. Linear belts of shrubs and trees would be created as part of the Scheme, to a greater extent than that which is lost, which would result in a ***minor beneficial effect***, within a local context. The loss to gain ratio of this habitat is considered in more detail in the Green Infrastructure Statement**, Appendix 8E, Volume 3.**

Great crested newts and other amphibians

8.6.7 The baseline conditions for habitat suitable for great crested newts and other amphibians has changed since surveys began in 2018. In several areas the

habitat has deteriorated and has been subject to considerable clearance relating to maintenance and improvement works on the wastewater treatment facilities. Tall ruderal and grassland habitat has been lost to the northwest of the wastewater treatment works (WwTW) and an area adjacent to the Queensferry Drain would also be lost under the current scheme proposals. A single GCN was discovered within the WwTW in 2020 (**Figure 8.4B**), but all surveys (amphibian and reptile) undertaken since then have returned no further evidence of GCN or other amphibians. Additionally, this location is one of those which has altered significantly over time. Due to the presence of an electricity pylon within approximately 10-15 m of the location in which the GCN was discovered in 2020, the area has been subject to vegetation clearance on numerous occasions to enable emergency repairs. This location has also seen substantial alterations as a result of WwTW enhancement works.

8.6.8 The Scheme proposals involve the relocation of the Queensferry Drain approximately 15 metres to the south-east and parallel with the A494 road corridor. The replacement Queensferry Drain would be in open channel for much if its length and be flanked by ditch banks and a wide swathe (approximately 15 metres in width) of soft estate composed of species rich grassland and native hedgerows along the boundary of the WwTW.

8.6.9 This area of additional land has been identified as essential mitigation to compensate for the loss of scrub and ruderal vegetation that currently runs alongside the existing Queensferry Drain. The introduction of species rich hedgerows to provide linear terrestrial habitat would also provide suitable foraging habitat for bats with the creation of dark corridors away from light sources along the A494 road corridor during night-time.

8.6.10 This additional area of soft estate, alongside Queensferry Drain in open channel, would provide an enhanced terrestrial habitat suitable for great crested newts and amphibians and therefore it is considered that the residual impact of the Scheme would represent a ***slight beneficial*** effect.

Badger

8.6.11 Badger setts occur in close proximity to the Scheme extents. The setts are located within the railway embankment adjacent to the wastewater treatment works. Site preparation works or works to the footpath may encroach upon badger setts. An exclusion zone around active setts with a buffer of 30 m from the Scheme would be in place. There would be the permanent loss of foraging and commuting habitat within the wastewater treatment works and the Queensferry Drain and along the railway embankment.

8.6.12 The proposed landscape planting would provide some mitigation for the loss of existing habitat, once established. Badgers would still be able to access these areas, once the road is operational. The existing and proposed levels would be approximately the same, however, the Queensferry drain would be realigned and between the realigned drain and existing A494 road, a maintenance access strip and shared use access track would be constructed. Badgers would still have access to the vegetated railway strip.

8.6.13 In the absence of mitigation, land take effects upon badgers (a receptor of local importance) are considered to represent a ***slight adverse effect.***

8.6.14 Pre-construction surveys for badger setts would be conducted to ensure that no setts have been created within the area of land take between the initial surveys and the site preparation and clearance works. These will be conducted 3 months prior to the commencement of onsite work, and repeated as necessary, prior to and during the Scheme. If works are within 30 m of an active badger sett, a licence from NRW would be required, dependent upon the scale of disturbance.

8.6.15 At the time of writing, no setts would be lost and habitat along the railway line and within other areas such as the treatment works, together with additional tree and hedgerow planting, means that access for badgers to the wider landscape would be maintained. Taking these factors into consideration, the residual effect is considered to be ***neutral***.

Otter

8.6.16 Otters are a feature of interest of the River Dee and Bala Lake SAC which is crossed by the Scheme and evidence of otters has been found along the River Dee. Suitable secure sites for natal dens are absent from the Scheme footprint and, although there are suitable rest-up areas within trees and scrub, no confirmed otter holts were recorded.

8.6.17 Land take effects on otters would occur in the short term, for the construction of the new bridge, shared use paths and for the formation of the outlets for Queensferry Drain and maintenance access. However, passage for otters within the River Dee would be maintained. In the absence of mitigation, land take effects upon otters (a receptor of National importance) are considered to be of a ***slight adverse effect***.

8.6.18 All habitat along the Dee will be reinstated. No additional mitigation for land take is proposed. However, the habitat to be created once the existing bridge abutments have been removed would provide additional cover, once established.

8.6.19 The residual effect to otters is considered to be ***neutral***. The Scheme is not likely to be detrimental to the maintenance of the favourable conservation status of otters at a local, county, regional or UK spatial scale.

Terrestrial breeding birds

8.6.20 Breeding birds would be affected by land take in the form of loss of suitable habitat including trees, scrub, hedgerows and farmland. Of Annex 1 species, only kingfisher have been recorded during previous surveys to the small gulley area south of the A494 bridge, where the initial observations were made but suitable breeding habitat along this area was not confirmed. As the proposed development will potentially require the removal or impact of banks, scrub grassland, farmland and wooded areas, there will likely be a reduction of nesting, foraging, commuting and roosting habitats for breeding birds, in the short term.

8.6.21 There were distinct areas in which likely breeding birds did concentrate and (or) were successful rearing young. These notable areas (and their distance from the Scheme footprint) include:

a) Industrial buildings (300 m);
b) Shrubs and scrub area (0 m);
c) Small gulley located south of the A494 bridge (25 m); and
d) Arable land, north-west of the A494 bridge (50 m)

8.6.22 Arable lands both east and west of the A494 bridge supported reed bunting, skylark and linnet. Birds were seen in pairs, but no nests were identified.

8.6.23 The wastewater treatment works was identified as an important foraging area for swifts, swallows and house martins. Although access to this area was limited, birds could be seen in numbers of 50+ foraging in the area.

8.6.24 In the absence of mitigation, land take effects upon breeding birds (a receptor of ***county*** importance) are considered to be a ***slight adverse effect***. Works would be timed so as to avoid the removal of vegetation within the nesting bird season or checks by an ecologist will be made prior to clearance. The Scheme would incorporate landscaping which will provide suitable habitat for nesting and foraging and the arable land used as a construction compound would be reinstated. The residual effect of land take is considered to be ***neutral.***

Terrestrial overwintering birds

8.6.25 During surveys there were distinct areas in which species concentrated and appeared to be of more value than others. These notable areas include the following (with distance from the Scheme footprint):

a) Running watercourse (River Dee) (0 m);
b) Rocky embankments exposed during low tide (220 m);
c) Riverbanks (0 m); and
d) Grassland and arable land, north-west of the A494 bridge (50 m).

8.6.26 Of these, the riverbanks and arable land would be subject to permanent and temporary land take. In addition, there would be the loss of tree lines within the

vicinity of the Scheme which provide winter foraging and roosting habitats for passerines such as warblers, thrushes and finches and may facilitate their movement across the landscape. The grassland and arable land in the vicinity of the Scheme provide winter foraging opportunities for some species.

8.6.27 The majority of roosting species located within the site were primarily identified as using the small, rocky bays which were located >150 m away from the proposed bridge works, on either side. In addition, species identified were never noted as utilising the areas beneath the bridge for roosting or feeding.

8.6.28 Overall, the land take required for the Scheme is not anticipated to have a substantial impact on wintering birds, given that the proposed areas subject to removal, both permanent and temporary, are already exposed to considerable disturbances due to their proximity to existing roads, public spaces, and cycle networks. Additionally, existing more suitable habitats are accessible in close proximity to the Scheme and would be left undisturbed.

8.6.29 In the absence of mitigation, land take effects upon wintering birds (a receptor of ***county*** importance) are considered to be of a ***Slight adverse effect***.

8.6.30 The Scheme would incorporate landscaping which will provide suitable habitat for overwintering birds and the arable land used as a construction compound would be reinstated. The residual effect to terrestrial overwintering birds in terms of land take is considered to be ***neutral.***

Bats

8.6.31 The effects of land take on bats include loss of habitat, destruction of roosts and, possibly, risks of mortality and habitat fragmentation. There would be the loss of foraging and commuting habitat within the wastewater treatment works and Queensferry drain and the removal of linear tree belts. The poplar tree line to the east of the treatment works, which had a high total count of bat passes, would be retained and the RPZ protected.

8.6.32 Two known roosts would be destroyed, one is located at 3 Bridge Houses, Chester Road East, the second is located within the electricity substation

adjacent to the NRW pumping station. It is possible that bats roost within the adjacent houses located along Chester Road East, although no confirmed roosts were noted within these during the surveys conducted between 2018 and 2024. Taking into consideration the mobile nature of bats, mitigation measures would include pre-demolition surveys of buildings to be demolished. The demolition of the known roosts (and any others noted as the Scheme progresses) would require an EPS licence from NRW. The draft licence for this roost has been discussed with NRW as described in Section 8.5.

8.6.33 The proposed landscape planting would mitigate for the loss of existing habitat as it would include linear features such as hedgerows, ditches providing linear water features, native tree and shrub planting, individual trees and grassland habitat. This will be planted to encourage use by bats. The extent of the proposed landscape planting is shown on **Figure 2.3A to D.**

8.6.34 Ecologists will update the surveys of the structures to be demolished. Surveys will be conducted within the active season for bats preceding the start on site. Demolition of the disused houses on Chester Road East, one of which has an identified bat roost, and the electricity substation adjacent to the NRW pumping station, will only proceed once a Protected Species development licence issued by NRW has been obtained, for each of these roosts. All works affecting this roost will follow the methods and terms of that licence.

8.6.35 If additional roosts are found before works commence, and licences are required, licence applications would be prepared and discussed with NRW at the earliest opportunity to avoid delays when the formal applications are made.

8.6.36 In the absence of mitigation, land take effects upon bats (a receptor of ***local importance***) are considered to represent a ***slight adverse effect***.

8.6.37 Mitigation for the loss of the roost at the properties located off Chester Road East would be provided in the form of pole-mounted bat boxes suitable for a range of crevice-dwelling species. These would be located within land adjacent to the Makro SuDS pond and next to the newly created drain and biodiversity habitat, including a double hedge. This is close to the location of the roost to be

destroyed and would provide connectivity to the railway. In addition, combined summer / winter bat boxes would be installed on trees to be retained.

8.6.38 Mitigation for the loss of the roost within the electricity substation would involve the creation of a new roost within 100 m, adjacent to River Dee and within environmental greenspace. The new roost would consist of like for like construction; detailed design of the new roost would be submitted as part of the full licence application.

8.6.39 Generally, based on the evidence gathered and literature review, the current population status of pipistrelle bats is estimated to be favourable, whilst the favourable conservation status is unknown. It is considered that in line with guidance[76] the Scheme would not worsen this status within a site, county, regional or UK context nor be detrimental to the maintenance or restoration of the population of the pipistrelle bat to a Favourable Conservation Status within their natural range (neutral effect). New roosts would be created as mitigation for the loss of existing roosts where pipistrelle bats were discovered during the surveys, and new habitat created.

8.6.40 The residual effect to bats in terms of land take is considered to be ***neutral***.

8.7 Assessment of Construction Effects

8.7.1 In this section, the potential effects during the construction phase of the Scheme, which also includes the demolition of the existing bridge, on each of the VERs as listed within **Table 8-16** are identified and assessed, first without mitigation and then with mitigation, to determine the significance of residual effects.

8.7.2 The main construction activities associated with the Scheme include:

a) Demolition and site clearance;

[76] European Commission, Brussels, 12.10.2021 C (2021) 7301 final. Commission notice Guidance document on the strict protection of animal species of Community interest under the Habitats Directive

b) Associated earthworks required for the designed highway alignment as well as for drainage, structures and landscaping works;

c) Construction and diversion of drainage systems;

d) Construction of new structures including a new pumping station;

e) Construction of the new and improved sections of the carriageway;

f) Construction of new access roads;

g) Construction of new shared use pathways;

h) Piling works;

i) Lighting requirements

8.7.3 There is also the requirement for utility diversions, details of which are described further in Chapter 2. The utility provider would be responsible for undertaking all the necessary surveys and assessment for their own diversion work.

8.7.4 Construction activities are provided in Chapter 2 of this ES and described in more detail in the Construction Buildability and Phasing Report. At the time of writing, full details were unknown and were in discussion with contractor, a summary of methods available at the time of writing is provided below for information. The effects of the Scheme are based on the 'worst case scenario' in terms of construction and demolition methods.

Proposed construction method

8.7.5 The following text provides a summary of proposed construction methods detailed description of the proposed construction method is provided in Chapter 2

8.7.6 To construct the bridge, it is proposed that a piling rig mounted on a jack-up barge would be used to drive thin-walled steel tubes into the riverbed.

8.7.7 The foundation piles would be constructed by using rotary bored pile method from the jack up barge. The jack-up barge would be served from a temporary jetty on the eastern bank 6

8.7.8 Piles will be driven using steel casing tubes into riverbed (rotary boring piling techniques) to depth sufficient to achieve stability and a seal to minimise water ingress and contain disturbed silts. The casings are expected to be installed into the glacial till to an estimated total depth below riverbed level of approximately 13 m. Tubes will be transported from banks or barge by crane and lowered vertically into position to be oscillated or driven in with vibration to a depth of approximately 34 m below riverbed level (assuming bed level is 0m AOD). Arisings from auger rotary bore will be captured, transported to land and disposed of in line with relevant waste regulations to minimise material inputs to the river.

8.7.9 For the formation of the abutments and remainder of the bridge construction, the Queensferry Drain outfall will be moved to its new position south of the existing outfall.

8.7.10 Demolition of the existing bridge would be done progressively, by removing surfacing and any other equipment, demolish the surfacing from the centre towards the abutments. Protection measures would be installed to ensure no debris falls into the river. The removal would require cranes positioned on banks. The abutments would be demolished and landscaped. The existing river piles will remain *in-situ* and cut down to an agreed level.

8.7.11 Landscaping will be carried out along the riverbanks upon completion of the bridge removal.

8.7.12 The construction programme for the main works would have a duration of between 2-3 years, as described in Chapter 2 and the anticipated start date (subject to approvals) is Spring 2027.

8.7.13 Some activities would extend beyond the main construction period. These would include demobilisation of works compounds and seasonally constrained activities such as landscaping.

8.7.14 The possible effects arising from construction include disruption and increased noise, release of pollutants and temporary lighting for site compounds. For the

purposes of this assessment, the mitigation measures referred to in Section 8.5 are considered to be an integral part of the Scheme.

8.7.15 Mitigation measures would be recorded in the CEMP. Task-specific mitigation measures would also be included in Risk Assessment and Method Statements to be developed before related works commence. Mitigation measures would also be detailed within species specific development licences.

Statutory designated sites and associated habitats

8.7.16 The River Dee SSSI includes intertidal mud and sandflats and saltmarsh which are habitats that would be directly affected by construction of the new bridge and demolition of the existing bridge. Species that are a primary reason for selection / designation of the River Dee and Bala Lake SAC and the River Dee SSSI could be exposed to indirect effects. Salmonids, sea and river lamprey and European Smelt could be exposed to pollution incidents and/or changes in water quality as described above. Further information of the effects on the water environment and marine ecology and recommended mitigation is provided in Chapter 7 (Road Drainage and the Water Environment) and Chapter 16 (Marine Environment). Further consideration of potential impacts on designated sites is given in the Habitats Regulations Assessment (HRA), provided as a separate document to the ES.

8.7.17 The effects of changes in air quality resulting from construction of the replacement bridge, and demolition of the existing bridge, are described in Chapter 11, Air Quality. This has shown the potential effects of elevated NOx concentrations on designated sites. The Air Quality Assessment identified two designated sites within 200 m of the Affected Road Network (ARN) of the proposed Scheme. These are the River Dee and Bala Lake SAC/SSSI. This site is also within 200 m of the Operational ARN for the Scheme.

8.7.18 As the Scheme crosses the designated sites, there will be a risk that the habitats and features of interest of the sites could be affected by dust. Dust sources from works close to the River Dee include concrete dust during the demolition of the existing bridge, together with dust from other man-made

materials. Natural soils, if mobilised as dust, would not be expected to affect a silt-laden river that flows through agricultural land for most of its length. The Institute of Air Quality Management (IAQM) guidance states that the aim would be to prevent significant effects on receptors through the use of effective mitigation.

8.7.19 In the section of the River Dee SSSI/River Dee and Bala Lake SAC located within 200 m of the ARN, there is broadleaved deciduous woodland and Atlantic upper-mid & mid- low salt marshes along the riverbanks. These two habitats are located adjacent to both the existing and realigned A494 River Dee Bridge, and as such the habitats likely to experience the greatest impact from air quality would not change.

8.7.20 The background nitrogen deposition at the broadleaved deciduous woodland is 32.5 kg N/ha/year and 18.1 kg N/ha/year for the salt marshes, which is higher than the minimum critical load of 10 kg N/ha/year set for both habitat types. Therefore, the minimum nitrogen deposition critical load is already exceeded with the existing A494 River Dee Bridge in place, and so no new exceedances would be created at habitats with the A494 River Dee Bridge realignment. Further details including recommended mitigation are provided in Chapter 11.

8.7.21 In the absence of mitigation, construction (including demolition of the existing bridge) effects upon the designated sites (a receptor of International importance) are considered to represent a ***moderate adverse effect***. These sites are considered in more detail in Chapter 16, Marine Environment.

8.7.22 A hydrodynamic and sediment transport study was conducted to assess the impact of the replacement bridge at Queensferry to include for three different scenarios under mean spring tide with low and high river discharge conditions:

a) Scenario 1 – Existing Bridge only;
b) Scenario 2 – Existing and proposed Bridge together; and
c) Scenario 3 – New Bridge only (existing Bridge removed).

8.7.23 Refer to the Hydrodynamic and Sediment Transport Modelling Report (Chapter 7) for full details of the assessment. The study concludes that the construction

of the new A494 Bridge will not significantly alter water levels but will lead to localised changes in current speeds and flow patterns. The presence of additional Bridge piles in Scenario 2, increases eddy formation and slightly modifies current speeds, though these changes do not result in large-scale hydrodynamic impacts. In Scenario 3, the removal of the existing Bridge allows for flow redistribution, leading to minor increases in flood current speeds and more pronounced eddy formation.

8.7.24 While sediment transport patterns remain largely consistent across scenarios, localised areas of erosion and deposition occur particularly near the Bridge piles, without significantly disrupting overall sediment dynamics. Overall, while the new Bridge influences localised flow conditions, its broader impact on tidal regime and sediment transport remains limited.

8.7.25 A modelling study has been conducted by Mott MacDonald to assess the impact of underwater noise produced during piling within the river on migratory fish. This is reported within Chapter 16, Marine Environment.

8.7.26 The control of pollution and management of noise and dust are integral to the proposed construction method. All mitigation would be recorded in the CEMP.

8.7.27 Construction and demolition phase operations would be carried out in accordance with Pollution Prevention Guidance. Site run-off would not be allowed to contaminate existing watercourses. Such measures would include silt fencing, filtration systems and pollution prevention equipment. NRW would be consulted on watercourse protection measures as appropriate. To minimise the risk of pollution to the marine environment, boring within the pile casings will minimise loss of material as silt to the water body and concrete works will be carried out with containment to prevent loss of concrete to the water body. Further information is provided in Chapter 7 Road Drainage and the Water Environment and Chapter 16, Marine Ecology.

Great crested newts and other amphibians

8.7.28 The main effect on great crested newts and amphibians is considered to be the direct loss of habitat from land take**.** Construction effects include direct

mortality during site preparation and clearance, passing construction traffic and dewatering activities for the Queensferry Drain.

8.7.29 There would be no loss of breeding ponds, or habitat fragmentation.

8.7.30 Reasonable Avoidance Measures (RAMs) for great crested newts would be set out within the CEMP. This includes the presence of an ecologist during site clearance to conduct a site walkover of habitat with the potential to support amphibians, stage strimming of vegetation before clearance and ecological supervision of the draining of Queensferry Drain.

8.7.31 In the absence of mitigation, construction effects upon amphibians (a receptor of ***local importance***) are considered to represent a *slight adverse effect*.

8.7.32 With the adoption of Reasonable Avoidance Measures, and the potential to restore some of the habitat lost, the residual impact is considered ***neutral.***

Badger

8.7.33 In the absence of any mitigation measures there is the potential for a negative impact at a local level on badgers, with a risk of injury, death or disturbance as a result of the works. This would be monitored as the Scheme progresses.

8.7.34 Site clearance would result in the destruction and loss of an area of terrestrial habitat which badgers use for dispersal and foraging.

8.7.35 Sudden lighting near sett entrances, well-used paths and crossing points can delay emergence, shorten foraging windows and discourage movement across newly illuminated verges or embankments, creating short-term displacement and fragmentation until temporary lighting is removed or screened. Where compounds sit close to vegetated corridors or public rights of way, a minor adverse change is plausible during night works, consistent with the ELIA's prediction of localised construction-stage effects near compound interfaces. Oversize deliveries or junction tie-ins undertaken outside core hours could extend these periods of illumination and associated disturbance.

8.7.36 In the absence of mitigation, construction effects upon badgers (a receptor of local importance) are considered a ***slight adverse effect***.

8.7.37 RAMs for badgers would be set out within the CEMP. An exclusion zone would be set up around active setts, with a buffer of 30 m. The line of the new road and other areas, such as contractors' compounds etc, will be re-surveyed within 3 months prior to construction to update the original survey and to ensure that no setts have been created in the interim period which may be disturbed / destroyed as a result of the works. Mitigation will be adjusted as necessary. Sensitive lighting around setts and foraging areas will be employed if overnight work is essential near this area.

8.7.38 Temporary lighting will be planned and managed to keep sett entrances, well-used paths and habitual crossing points in darkness wherever practicable, with towers and compounds set back from these features and luminaires aimed away from vegetated corridors. Construction lighting will operate only during active working hours and be switched off outside these periods, with security lighting on motion sensors and, where feasible, infra-red rather than visible light to avoid continuous illumination. Shielding and photometric controls such as baffles, hoods or louvres will be used to cut glare and spill, and on-site light levels will be checked against ILP GN01 limits using PLG04 methods so adjustments can be made if required, all secured through the CEMP.

8.7.39 If a sett, or suspected sett, is discovered the ecologist will be contacted and, if necessary, a licence to close the sett will be obtained from NRW. If works are within 30 m of an active badger sett, a licence from NRW would be required, dependent upon the scale of disturbance.

8.7.40 With the adoption of Reasonable Avoidance Measures and the retention of access to suitable habitat locally and in the wider environment, no significant negative impact is anticipated on badgers using the site at either a local, regional or national level, and the favourable conservation status and Continued Ecological Functionality (CEF) of the species will not be impacted by the proposed new road alignment, in the long term. The key component of the mitigation strategy is to maintain a buffer from the existing setts, maintain

access to alternative suitable habitat and continued monitoring of activity throughout the construction of the Scheme. The residual impact is considered to be ***neutral***.

Otter

8.7.41 Although largely nocturnal, otters may nevertheless be disturbed by construction and demolition phases of the Scheme, including during any such activities adjacent to the River Dee. Their movement along the riverbank may be obstructed by construction materials or activities, in particular any works which involve disturbance to the existing riverbanks. However, the River Dee itself would still be available for the passage of otters.

8.7.42 There may be requirement for some nighttime operations. During the construction period, the two temporary site compounds are likely to be floodlit at night for security, and such lighting may be required for the construction of the bridge.

8.7.43 Artificial lighting may discourage otters from using the River Dee as a means of passage. Road lighting was removed from the existing bridge as a result of deterioration, but some nearby lighting still spills onto the River Dee corridor. Additional night-time lighting will be used only where and when it is essential for safety. During the construction period, the two temporary site compounds are likely to be floodlit at night to allow for night-time working and for security reasons.

8.7.44 Illumination of bankside working areas, under-bridge activities and compound perimeters near the river can deter shoreline movements, reduce the use of haul-outs and increase hesitation at crossing points, with reflections and glare off the water surface amplifying the effect. The Environmental Lighting Impact Assessment (**Chapter 9, Vol 3, Appendix F**) recognises spill to water as a relevant pathway and security lighting concentrated at site entrances and boundaries may locally elevate brightness along sections of bank used for commuting and foraging during the construction phase.

8.7.45 In the absence of mitigation, construction effects upon otters a (a receptor of National) are considered to be a ***slight adverse impact***.

8.7.46 Reasonable Avoidance Measures for otters include the installation of a means of escape to any deep excavations (>0.5 m) left open overnight and the maintenance of access within the River Dee. An ecologist will conduct a site walkover and inspection before site clearance of any scrub or vegetation along the River Dee and site personnel will be briefed on the need to avoid disturbance of otters.

8.7.47 Lighting associated with riverside works, bridge activities and compound perimeters near the bank will be controlled to maintain dark shorelines, using directional aiming and rear-light shields to prevent illumination of the water surface and riverside haul-outs, with equipment switched off when not in use. Where reactive maintenance is required at the Queensferry Drain pumping station, task lighting will be confined to the specific work area only, with routine activities scheduled for daylight to avoid unnecessary night-time lighting. Security lighting will rely on motion-activation and short timers to limit duration, and the overall approach will be delivered under the CEMP using GN01-compliant design and site monitoring so that measures can be adapted if effects are identified.

8.7.48 With the adoption of Reasonable Avoidance Measures and pollution prevention measures as detailed within the CEMP, the maintenance of access along the River Dee and limited overnight working or illumination of the banks of the River Dee, the residual impact is considered to be ***neutral***. The Scheme is not likely to be detrimental to the maintenance of the favourable conservation status of otters at a local, county, regional or UK spatial scale.

Terrestrial breeding birds

8.7.49 Construction activities have the potential to damage and/or destroy active birds' nest through building and infrastructure decommissioning or placement, vegetation removal, bank excavation, placements of compounds, access routes, laydown areas and footfall through an unmanaged area.

8.7.50 Given that the works at the location of the replacement bridge and decommission of the existing bridge are within an area where human disturbance is considered high, the potential for disturbance of species breeding in the vicinity is likely to be relatively low as local populations have likely habituated to such disturbances. Nonetheless, vibration, noise, increased lighting and an increase in human activity could potentially disturb and displace breeding, notable and / or priority bird species.

8.7.51 Disturbance to breeding birds will mostly be attributed to noise from construction activities which is typically of low frequency but high amplitude. Construction methods such as percussive piling are known to be a particular issue in relation to disturbance[77], with noise levels above 70db(A) at the receptor likely to cause moderate to high effects. In general, birds tend to habituate to continual noises so long as there is no large amplitude 'startling' component, with vehicle movements being more greatly tolerated.

8.7.52 In the absence of mitigation, effects upon breeding birds (a receptor of ***county importance***) are considered to be a ***slight adverse effect***.

8.7.53 Kingfisher have been recorded adjacent to the existing A494 bridge, though no breeding has been confirmed.

8.7.54 Should the works impact the banks of the River Dee between March and the end of the breeding period (August 31st), then a preconstruction nesting bird check specifically for kingfisher would be completed by a suitably experienced ornithologist prior to the works taking place. If an active nest is identified then a protection buffer will be placed around the nest site, which will be set at the discretion of an experienced ornithologist and remain in place until the young have fledged.

8.7.55 Any vegetation clearance as part of the Scheme would be undertaken outside of the main breeding bird season (clearance to be undertaken between September to February). If clearance outside of March to August is not

[77] Hill, D., Hockin, D., Price, D., Tucker, G., Morris, R. and Treweek, J., 1997. Bird disturbance: improving the quality and utility of disturbance research. Journal of Applied Ecology 34, 275– 288

achievable, suitable nesting habitat would be checked immediately prior to removal by a suitably experienced ornithologist (no more than 48 hours) in order to confirm that no nesting birds are present. Should an active nest be found, then an appropriate exclusion area around the nest site would be established in liaison with the ornithologist, and the works within that area would cease until all young birds are fledged. The exclusion zone will vary depending on species.

8.7.56 Noise disturbance should be minimised by implementing good industry practice such as BS 5228-1:2009+A1:2 014.22[78]. Other measures would include selection of equipment for its lower noise generating properties (i.e. low noise generators and compressors for Ground Investigation and related works), attenuation to noise sources (i.e. silencers or enclosures/shrouds).

8.7.57 To avoid nocturnal disturbance to breeding birds via artificial lighting, it is advised that no work is undertaken during the hours of darkness within the government-defined breeding season (i.e. March to August, inclusive). However, if this is unavoidable, a sensitive lighting design is recommended to minimise light spill onto linear features / site boundaries. Directional lighting and screening may be appropriate to alleviate light spill, this includes lighting required at the construction compound, issues onto other habitats such as grasslands, the River Dee, farmlands and buildings.

8.7.58 With the adoption of RAMs as set out within the breeding bird survey reports (and summarised in the previous sections), and the potential to restore some of the habitat lost, the residual impact upon local breeding bird assemblages is considered to be ***neutral.***

8.7.59 Further information is provided in the Ornithology reports**, Appendix 8B**, Volume 3 of the ES and the Marine Ecology Chapter.

[78] 2 BS 5228-1:2009+A1:2014 - Code of practice for noise and vibration control on construction and open sites" (2014) BSI Group, available at: Available at https://landingpage.bsigroup.com/LandingPage/Standard?UPI=000000000030258086 [Accessed 17/03/2025]

Terrestrial wintering birds

8.7.60 The potential impacts of the Scheme on terrestrial non-breeding birds may include but are not limited to:

a) Loss and fragmentation of foraging habitat;

b) indirect impact to foraging resource as a result of dredging and silt mobilisation

c) Increased levels of disturbance resulting from noise and light.

8.7.61 The resulting effects may include:

a) A reduction in species richness and/or abundance;

b) Displacement of birds from foraging sites; and

c) A reduction in overwinter survival.

8.7.62 It is likely, considering the existing baseline noise levels and observed response behaviour noted during surveys to date, that where birds are displaced during construction, this would be temporary with return upon the cessation of disturbance. No long-term effects.

8.7.63 Overall, the Scheme is not anticipated to have a substantial impact on overwintering birds, given that the proposed habitat loss areas are already exposed to considerable disturbances due to their proximity to existing roads, public spaces, and cycle networks. Additionally, compensatory bird habitats are accessible in close proximity to the areas of habitat loss.

8.7.64 Further information and assessment can be found in the Ornithology reports, Volume 3 and Chapter 16, Marine Ecology.

8.7.65 In the absence of mitigation, effects upon wintering birds (a receptor of ***county*** importance) are considered to be a ***slight adverse effect***.

8.7.66 To reduce disturbance and displacement during the construction and demolition phase, quieter operating plant and machinery would be used where possible.

8.7.67 With the adoption of Reasonable Avoidance Measures as set out within the bird survey reports and the Marine Environment (Chapter 16) and the potential to restore some of the habitat lost, the residual impact upon local bird assemblages is considered to be ***neutral.***

Bats

8.7.68 Construction-stage effects on bats include the temporary lighting and increased disturbance from construction traffic and noise.

8.7.69 In order to construct the bridge and new road, and for works to the existing bridge, some night-time operations are likely to be required. Artificial lighting for these operations may discourage bats from utilising existing commuting and foraging routes. During the construction period, the two temporary site compounds are likely to be floodlit at night to allow for night-time working and for security reasons.

8.7.70 Construction-stage security and task lighting can illuminate roost access points and dark commuting routes along tree lines and the riparian corridor, causing avoidance, delayed emergence and altered flight lines, while re-distributing insect prey towards lit zones and away from preferred foraging habitat. Even within an E3 suburban context, unshielded or intensely bright sources can create effective barriers across otherwise continuous corridors, particularly where temporary compounds are positioned beside vegetated footpaths; the ELIA anticipates minor, localised change during construction in such locations, and its lighting approach is framed around ILP GN01 and GN08 to manage these risks (**Chapter 9, Vol 3, Appendix F**).

8.7.71 In the absence of mitigation, construction effects upon bats (a receptor of ***local importance***) are considered to be a ***slight adverse effect***.

8.7.72 The majority of construction activities will take place during the period of normal working hours, and any additional night-time lighting would be short term. Background noise, dominated by traffic, will remain throughout the construction period. Where habitat is temporarily lost, flightlines would be put in

place, for example mesh fencing, or instant hedges, to retain connectivity during the construction period.

8.7.73 Mitigation would be centred on preserving dark roost access, commuting lines and foraging corridors by siting and aiming task lights to avoid tree lines and the riparian edge, applying strict switch-off outside work hours, and selecting considerate security lighting controls so that light is present only when necessary. The lighting design and site controls will follow ILP/BCT GN08, with warmer white sources preferred where practicable to limit blue light and insect attraction, and with shielding to minimise spill and skyglow in line with GN01. Compliance will be demonstrated through obtrusive-light calculations and verified by on-site monitoring so that any residual effects can be further reduced during the works.

8.7.74 With the adoption of the proposed mitigation, including minimising working at night during seasons of bat activity, the residual impact is considered to be a ***neutral*** effect. The Scheme is not likely to be detrimental to the maintenance of the favourable conservation status of bats at a local, county, regional or UK spatial scale.

8.8 Assessment of Operational Effects

8.8.1 In this section the potential effects of operation of the Scheme, once open to traffic, on each of the VERs as detailed within are identified and assessed, first without mitigation and then with mitigation in order to determine the significance of residual effects.

8.8.2 Effects from the operation of the road include (but are not limited to) highway drainage, winter salting, potential increase in public access and vehicles, highway and active travel lighting, highway and landscape maintenance work and hydromorphological changes including changes to flow, velocity or sediment dynamics within the River Dee. For the purposes of this assessment, certain mitigation measures are considered to be an integral part of the Scheme.

8.8.3 Operational effects would be manifest throughout the life of the new section of the road and thus are considered to be long term effects unless otherwise stated.

Statutory designated sites and associated habitats

8.8.4 There will be no direct operational effects upon habitat features of interest of the Dee Estuary Ramsar, SPA and SAC. Indirect effects may occur from increased toxicity levels from road run-off and lighting proposals. An analysis of the long-term impacts of surface water run-off into the River Dee has been provided in Chapter 7 (Road Drainage and the Water Environment). Additional information is provided in Chapter 16 (Marine Environment). Further consideration of potential impacts on designated sites is given in the Habitats Regulations Assessment, provided as a separate document to the ES.

8.8.5 Highway drainage and run off from adjacent land would be collected by piped highway drainage systems. These would discharge into the realigned Queensferry Drain which will include a new pumping station with improved pumping rates. It benefits from catch-pit manholes, a section of open channel ‘swale’ and a penstock to help provide pollution control during spillage events.

8.8.6 Protection from accidental spillages would be provided by isolation systems allowing pollutants to be contained for safe disposal. The assessment of operational effects on the water environment is described in Chapter 7 Road Drainage and Water Environment.

8.8.7 The residual effects upon the designated sites and associated habitats are considered to be a are considered to be ***neutral.***

Great crested newts and other amphibians

8.8.8 In the long-term, there would be no isolation of breeding ponds. Only one pond RMLP4 was identified as containing GCN, this pond is already isolated. Queensferry drain would be realigned, and an additional drain would be created by opening up an existing culvert.

8.8.9 During the operational phase, the existing use of the site would not change significantly. The wastewater treatment plant is in use, and the habitat is subject to some regular maintenance, habitat surrounding Queensferry Drain is also subject to maintenance and vegetation strimming. Habitat surrounding RMLP4 which had a positive eDNA result for GCN is subject to heavy agricultural use, and this is unlikely to change.

8.8.10 The drainage design was not finalised at the time writing, this is likely to utilise gully pots, though these would not intersect any known potential migrating corridors, in addition, populations within the Scheme are considered to be low along the main Scheme footprint (one individual noted over the survey period).

8.8.11 In the absence of mitigation, operational effects upon amphibians (a receptor of local importance) are considered to be a ***slight adverse effect***.

8.8.12 The Scheme will include landscape planting Schemes to facilitate and retain connectivity, including scattered trees and native shrubs planted adjacent to the realigned road and new drains and the retention of planting and supplementary planting adjacent to RMLP1.

8.8.13 Where the sensitive design and management to reduce the effects of road-run-off during operation is instigated, the residual effects upon great crested newts and other amphibians may be a slight beneficial effect. This would be increased with the addition to the proposed open drains which connect to the Makro pond and each other via the intervening habitat, which includes the existing railway line.

8.8.14 Where there is the potential to incorporate amphibian friendly drainage detail, for example wildlife kerbs[79] and modified gully pots or kerb design, this would be instigated as an added mitigation measure.

8.8.15 With the advised mitigation measures, the residual effects upon amphibians considered are considered to be a ***slight beneficial effect.***

[79] Available at Wildlife Kerb | Aco Wildlife Kerb [Accessed 01/04/2025]

Badger

8.8.16 During the operation of the replacement bridge and new section of road, it is likely that the existing use of the site by badgers would not change significantly.

8.8.17 The wastewater treatment plant is in use, and the habitat is subject to some regular maintenance, though this is generally restricted to habitat edges. Access to the habitat to be created surrounding Queensferry Drain would still be available to the local badger population and would continue to be managed by NRW.

8.8.18 The alignment of the new section of road does not change significantly at the location of where badger activity was noted and there would still be access for badgers to the wider habitat via the railway corridor and to the river via the connecting treelines and footpaths to the northeast. Access would also be retained under the replacement bridge.

8.8.19 The PRoW which is routed between the railway line and wastewater treatment works would be retained and may be used more frequently than it is currently as it will provide access to a new cycleway/footpath, located adjacent to the new road. This PRoW passes a couple of the badger setts (BN1 and BN4) the other setts (BN3 and BN2) are behind the fence line of the railway embankments so would not be disturbed from potential users of this PRoW.

8.8.20 During operation, permanent road and path lighting will raise background night-time brightness and create light spill and occasional glare around verges, embankments and access points. For badgers, this can compress nocturnal activity into darker windows, delay emergence from setts and discourage crossings at consistently lit verge breaks or junction tie-ins, subtly shifting foraging ranges and path selection. Intermittent security or task lighting associated with the Queensferry Drain pumping station could also prompt startle responses if triggered near regular routes, vehicle headlight beams may intermittently sweep adjacent habitat and add to disturbance near approaches. Although the scheme is designed to E3 zone limits with zero-uplight optics and

warm sources, localised avoidance close to columns and entrances remains a plausible pathway for effect.

8.8.21 The operational lighting strategy keeps key terrestrial routes as dark as practicable by combining integral optical shielding on columns, zero-uplight optics and warmer colour temperatures so light is directed to the carriageway and away from vegetated corridors and sett approaches. Security lighting would be limited to motion-activated, short-duration use (with infrared options) to avoid prolonged illumination, and routine maintenance at the pumping station would be scheduled for daylight so trigger events at night are rare. To prevent over-lighting across the life of the installation, constant-light-output and permanent dimming settings are specified where required, with compliance checked through ILP GN01 obtrusive-light calculations and verified on site using PLG04 methods so adjustments can be made if needed.

8.8.22 The operational effects of the Scheme upon badgers (a receptor of local importance) are considered to be ***neutral.***

Otter

8.8.23 Otters utilise the River Dee for commuting and foraging. The operation of the road would not obstruct riverside access for otters.

8.8.24 Otters are accustomed to the current use of public rights of way along the banks of the River Dee, and so increased public access is not expected to have an effect. However, it is likely that there would a requirement for lighting along some sections of the active travel routes.

8.8.25 For otters using the river corridor, steady nighttime lighting around abutments, bankside paths and access points can discourage shoreline movements, increase hesitation at pinch points and reduce use of haul-outs, with glare and reflections off the water amplifying perceived brightness. Reactive maintenance at the pumping station may occasionally introduce task lighting after dark, though routine activities are directed to daylight hours; nevertheless, any spill to the water’s edge could temporarily displace animals along short reaches.

8.8.26 In the absence of mitigation, operational effects upon otters (a receptor of high importance) are considered to be a ***slight adverse impact***.

8.8.27 The operational approach to mitigation would involve maintaining dark river margins by specifying directional optics and back-light control so luminaires do not light the water surface or haul-out banks, with targeted rear-shields on the riverside columns where needed. Around the Queensferry Drain pumping station, lighting would normally be off, task-based and tightly bounded, with routine external maintenance avoided after dark; any essential security lighting would rely on motion sensors and may use infrared to reduce visible illumination. The scheme's GN01-compliant design is supported by a commitment to re-assess obtrusive light if design changes could increase spill, and by periodic PLG04 measurements to confirm that riverside illuminance remains at the intended, low levels.

8.8.28 With the instigation of sensitive, reduced or an avoidance of additional lighting, in particular where this affects watercourse and associated banks, the residual impact is considered to be ***neutral***.

Terrestrial breeding birds

8.8.29 With the creation of and maintenance of habitat as proposed, preferably not subject to direct light spill, and the installation of bird boxes, the impacts upon the breeding bird assemblages once the road is operational are anticipated to be ***neutral.***

Terrestrial overwintering birds

8.8.30 The noise levels from the operation of the new road will not alter significantly from the existing situation.

8.8.31 There is a requirement to light the replacement bridge, though lux levels are expected to be reduced, in comparison to the existing bridge, in line with improved current standards. In the absence of mitigation, operational effects upon wintering birds are considered to represent a ***slight adverse impact***.

8.8.32 The lighting columns would be placed in the central reservation with light directed to the roads, minimising light spill on the river. Warm spectrum LEDs would be used.

8.8.33 With the instigation of sensitive lighting, the residual impact is considered to be ***neutral***.

Bats

8.8.34 Operational effects on bats include the potential effects of lighting on vegetation which could be utilised for foraging and commuting as well as light spill onto proposed roosts.

8.8.35 Ongoing illumination of the bridge, junction areas and sections of shared-use paths could alter use of dark corridors, with spill towards treelines or the riparian edge acting as a partial barrier that delays emergence, diverts commuting flightlines and redistributes insect prey away from preferred foraging zones. Where light reaches the river surface, reflected brightness may further reduce willingness to cross under structures, particularly for light-averse species, and the absence of confirmed dimming profiles has been assessed on a reasonable worst-case basis. While the lighting concept applies GN01/GN08 principles, lower colour temperatures and back-light shielding at selected columns to reduce spill, residual, fine-scale behavioural change along sensitive edges is still a realistic risk pathway during operation.

8.8.36 A pole mounted bat box would mitigate for the loss of a roost within the properties to the west of the site, on a lane off Chester Road East (which provide access to Flintshire Depot). The location would be such that it would not be subject to light spill and the adjacent connecting habitat, including the double hedge, should also be maintained as a ‘dark corridor’. Habitat currently used by bats located to the rear of these properties is ‘dark’ with current light spill (in particular from the Makro car park) buffered by the existing tree line. Trees within the gardens would be retained, as would the boundary planting which currently provide screening. This, along with the additional planting

proposed, should offer a buffer to the light spill from the A494 and the new active travel route proposed at this location.

8.8.37 A bat house is proposed to mitigate for the loss of the roost within the electricity substation located adjacent to the pumping station. Both of these buildings are to be demolished. The replacement roost would be located within 100 m of the existing roost and adjacent to both existing and proposed habitat. This would provide a connection to the River Dee. Currently the area is unlit and is screened by light spill from the existing A494 by a treeline, this would be removed to make way for the realignment of the road and replacement bridge.

8.8.38 The active travel route which joins Foxes Lane to the Wales Coastal Path may also be lit. There is currently no lighting along here but generally the area is subject to light spill from the existing lighting along the A494. Additional lighting required for the active travel route would increase the light spill upon the habitats, proposed and retained. Bat activity was noted along here, though not in great numbers and generally by species which are more tolerant of artificial light at night.

8.8.39 In the absence of mitigation, operational effects upon bats (a receptor of local importance) are considered to be a ***slight adverse impact***.

8.8.40 Lighting impact mitigation would focus on safeguarding dark roost access and commuting/foraging corridors by applying ILP/BCT GN08 throughout detailed design alongside GN01: warmer light sources (≤2700–3000 K) reduce blue-rich content and insect draw, integral shields and careful aiming limit spill towards tree lines and the riparian edge, and only 0%-uplight or Dark Sky–approved optics would be used. Where columns are closest to the river, integral or supplementary back-light shields would be adopted to keep the water surface and banks in shadow, and pumping-station task lighting would be confined to essential, localised work areas with routine activities undertaken in daylight. Compliance would be evidenced by obtrusive-light calculations and followed by PLG04-led monitoring to confirm that post-curfew conditions remain within limits.

8.8.41 With the instigation of sensitive, reduced or an avoidance of additional lighting, in particular where this affects roosts and connecting habitat used by bats for foraging and commuting, the residual impact is considered to be ***neutral.*** The Scheme is not likely to be detrimental to the maintenance of the favourable conservation status of bats at a local, county, regional or UK spatial scale.

8.9 Monitoring

8.9.1 The purpose of monitoring is to:

a) ensure measures envisaged to avoid, prevent or reduce and, if possible, offset significant adverse effects on the environment are delivered;

b) build data on the effectiveness of design and mitigation measures thereby driving improvement in environmental performance for future projects;

c) satisfy licence / permit requirements (where applicable); and

d) identify remedial action as a consequence of underperformance or failure of mitigation.

8.9.2 Monitoring would be undertaken both during the construction and the operation of the Scheme to confirm the effectiveness of mitigation measures and, if necessary, to inform the need for any changes.

Monitoring during construction

8.9.3 The Contractor would be required to monitor the site during construction to ensure that all mitigation is in place. Where required, camera traps would be installed to record evidence of otter and/or badger movement.

8.9.4 Monitoring of watercourses at risk from pollution would be carried out during the construction phase. This would include visual assessments for oil and silt, supplemented by turbidity monitoring. Further detail on monitoring of watercourses is provided in Chapters 7, 16 and 19.

8.9.5 Monitoring as set out as part of the development licenses covering bats would also be adhered to, including monitoring during the demolition of bat roosts.

8.9.6 The establishment of the landscape elements included in the EMP (**Figure 2.3A** to **D**) would be monitored by the Contractor during the construction phase.

Monitoring during the initial 5-year aftercare

8.9.7 On completion of the construction phase, there would be a five-year aftercare period to ensure the establishment of the landscape and ecological elements of the Scheme. The environmental requirements for this period would be implemented through the Handover Environmental Management Plan (HEMP). The HEMP would be prepared by the contactor and developed out of the CEMP. It would detail the maintenance operations required to manage the soft estate for maintenance activities during the post-aftercare period, in accordance with the Welsh Government Trunk Road Maintenance Manual (WGTRMM).

8.9.8 An otter survey would be conducted once the Scheme is complete, to monitor continued use by otters of access under the new bridge.

8.9.9 Requirements for monitoring of protected species would be set out in the EPS licence Method Statements, including the bat licences relating to the known roosts which would be destroyed. Monitoring of the mitigation would be carried out once the road is open and all proposed mitigation has been installed. This monitoring, carried out as part of the five-year post-construction aftercare period, would include transect surveys along new habitat to show whether all previously recorded species are still utilising the site, and emergence surveys of the pole-mounted bat box and new bat house.

Reporting

8.9.10 The results of monitoring shall be reported through updates of the Environmental Management Plan (EMP) during construction and handover phases.

8.9.11 The results and evaluation of monitoring shall be reported to the Overseeing Organisation and/or competent authority. Any proposals for remedial action

shall be discussed and agreed with the Overseeing Organisation and/or competent authority on a case-by-case basis.

8.9.12 Any development licences would be subject to their own licence reporting processes and licence return forms.

8.10 Assessment of Cumulative Effects

8.10.1 Cumulative effects can result from individually insignificant but collectively significant actions taking place over a period of time or concentrated in a specific location. Different types of actions can cause cumulative impacts and effects including multiple projects added together to give rise to a significant effect due to their proximity in time and space.

8.10.2 The cumulative effects of the Scheme with other projects in the vicinity are addressed in Chapter 17 Cumulative Effects and Inter-relationships.

8.10.3 Cumulative effects on sites within the national sites network would also be addressed in the Statement to Inform the Appropriate Assessment.

8.10.4 The short-listed sites are described in detail in Chapter 17 and site locations shown on **Figure 17**.

8.10.5 Two projects were identified as having some possibility of resulting in cumulative effects to terrestrial biodiversity with the present scheme:

Connah's Quay Low Carbon Power 2 Phase Project (CQLCP)

- This project proposes the development of a new combined-cycle gas turbine (CCGT) power station, equipped with carbon capture and storage (CCS) technology. It is to be located on the 98-hectare site of the existing Connah's Quay power station, which forms part of the Deeside Industrial Park. The centre of this proposed development is situated approximately 4.5 km west (downstream) of the Dee Bridge scheme.

Tidal Lagoon in Dee Estuary, Mostyn Dock

- This project involves the construction of a tidal energy lagoon in the outer Dee Estuary. The design includes a 6.7 km boundary wall extending from the Port of Mostyn to the Point of Ayr at the mouth of the estuary. This is a large-scale marine engineering project located approximately 21 km west-northwest (downstream) of the Dee Bridge scheme.

Analysis of the Connah's Quay Low Carbon Power Project (4.5 km distance)

8.10.6 The CQLCP project is fundamentally a redevelopment and modernisation initiative located on a brownfield site that has hosted a power station for over 70 years. This location is within the Deeside Enterprise Zone, a landscape characterised by a high concentration of industrial and manufacturing activity. This context is critical, as the project does not represent a new incursion into a greenfield or semi-natural area. The primary sources of environmental impact from the project will be localised construction noise and activity, land take confined to the existing industrial footprint, and atmospheric emissions from stacks proposed to be up to 150 m in height. The project's own Environmental Impact Assessment Scoping Report has identified terrestrial and aquatic ecology as a key assessment topic, but the focus is necessarily on the immediate site and adjacent habitats, such as the Deeside Naturalists' Society reserve and local water outfalls.

Assessment of Impact Pathways on Dee Bridge VERs

8.10.7 A systematic review of potential impact pathways reveals no mechanism for significant cumulative effects on the terrestrial VERs at the Dee Bridge scheme.

8.10.8 **Direct Habitat Loss and Fragmentation:** There is no pathway for this impact. The two projects are physically separated by 4.5 km of intervening urban, industrial, and agricultural land. There is no direct ecological connectivity between the terrestrial habitats at the bridge site and the CQLCP site that could be severed or fragmented by the works.

8.10.9 **Hydrological Connectivity**: There is no significant pathway. The CQLCP site is located downstream of the Dee Bridge scheme. Any potential pollution from site runoff or operational discharge would enter the Dee Estuary and be transported seaward by tidal and fluvial action, away from the bridge site. There is no upstream hydrological connection that could affect the freshwater habitats, such as the Queensferry Drain or ponds, within the bridge scheme's ZoI.

8.10.10 **Atmospheric Pathways**: There is no significant pathway. While the proposed 150 m stacks are designed for the wide dispersal of emissions, the significant intervening distance of 4.5 km means that any deposition of pollutants such as nitrogen oxides (NO_x) at the bridge site would be highly diffuse. The incremental contribution would be negligible and effectively indistinguishable from the existing background levels originating from regional traffic and industry. The Dee Bridge scheme's ES has already assessed the impacts of background deposition and concluded that its own operational effects are not significant; the minor additional contribution from the CQLCP project would not alter this conclusion.

8.10.11 **Mobile Species Disturbance**: There is no significant pathway for population-level effects:

- **Otters**: Otters utilising the River Dee corridor will pass the CQLCP site. However, the construction activities are land-based and set back from the main river channel. Given the existing industrial nature of the Connah's Quay frontage, any otters using this stretch of the river are already habituated to a significant baseline level of human activity, noise, and light. It is highly improbable that the localised construction disturbance from this project would cause a population-level impact or alter the behaviour or viability of otters 4.5 km upstream at the bridge site.

- **Birds**: The proximity of the Deeside Naturalists' Society reserve to the existing power station demonstrates that bird populations utilise this industrialised landscape. However, the bird assemblages are

ecologically distinct. The reserve and its environs primarily support estuarine and wetland species, such as waders and wildfowl. In contrast, the key terrestrial bird VERs at the Dee Bridge site are passerine species associated with scrub, woodland, and grassland habitats. While some individual birds may move between the two areas, the 4.5 km separation and the difference in habitat types mean that construction disturbance at CQLCP will not have a significant cumulative effect on the specific terrestrial bird populations breeding and overwintering at the bridge.

- **Bats**: The Deeside Industrial Park is considered to offer low-value foraging habitat for bats. The primary commuting and foraging corridors for the bat populations identified at the Dee Bridge scheme are localised along the river, the railway line, and associated treelines. There is no evidence of a significant functional ecological link for bat populations between the two distinct sites.

Section Conclusion for CQLCP

8.10.12 The significant intervening distance, the brownfield nature of the CQLCP site, and the absence of any direct ecological or hydrological connectivity preclude any plausible mechanism by which the project could cause a significant cumulative impact on the terrestrial VERs of the Dee Bridge scheme. The existing industrial baseline at Connah's Quay means that local wildlife is already adapted to a degree of disturbance, and the incremental change from the new development is highly unlikely to generate impacts that could radiate 4.5 km upstream and affect different ecological receptors in a different habitat context.

Analysis of the Mostyn Dock Tidal Lagoon Project (21 km distance)

8.10.13 The proposed tidal lagoon is an entirely marine and coastal engineering scheme located in the outer Dee Estuary. Its physical footprint consists of the 6.7 km lagoon wall, turbines, and sluice gates, with all major construction and operational effects occurring within the marine environment. The primary

impact sources are the alteration of hydrodynamic processes (tidal range, currents) and sediment transport regimes, the direct loss of intertidal habitat beneath the wall's footprint, and potential effects on marine species, including fish, marine mammals, and estuarine birds. Any terrestrial impacts are confined to the construction and assembly areas at the Port of Mostyn, 21 km from the Dee Bridge scheme.

Assessment of Impact Pathways on Dee Bridge VERs

8.10.14 The geographical separation and the fundamentally different nature of this project mean there are no significant impact pathways to the terrestrial VERs at the Dee Bridge.

8.10.15 **Direct Habitat Loss and Fragmentation**: There is no pathway. The projects are 21 km apart and have no terrestrial connection.

8.10.16 **Hydrological Connectivity**: There is no significant pathway. The lagoon's primary function is to alter tidal hydrodynamics in the outer estuary. While hydrodynamic modelling predicts far-field effects on tidal range and currents, these are confined to the marine environment. Any resultant change in the fluvial-dominated, channelised section of the River Dee, located 21 km upstream, would be imperceptible. It would be entirely masked by the river's own flow dynamics, which are heavily managed by upstream reservoir releases. There is no pathway by which this project could affect the terrestrial ponds or drainage systems at the bridge site.

8.10.17 **Atmospheric Pathways**: There is no pathway. This is a marine construction project with no significant sources of atmospheric emissions that could affect a site 21 km away.

8.10.18 **Mobile Species Disturbance**: There is no significant pathway for population-level effects.

- **Otters:** Otters are known to forage in coastal and estuarine environments. The lagoon could alter foraging grounds in a section of the outer estuary. However, the otter is a highly mobile species with an

extensive home range that can cover the entire Dee catchment. The alteration of one part of its potential foraging area, 21 km away, is highly unlikely to have a measurable impact on the health, behaviour, or viability of the specific otters using the freshwater river corridor at the Dee Bridge. The population is considered sufficiently resilient to adapt to such a distant and partial habitat modification.

- **Birds:** This represents the most plausible, yet still insignificant, potential pathway. The lagoon will directly impact intertidal feeding areas used by waders and wildfowl, which are qualifying features of the Dee Estuary SPA and Ramsar site. These bird populations are highly mobile and utilise the entire Dee Estuary, a vast ecosystem of approximately 15,000 hectares. While some displacement of birds from the lagoon footprint will inevitably occur, the affected individuals have extensive alternative feeding and roosting grounds available throughout the wider estuary. A key point of disconnection is that the species most likely to be affected by the lagoon (intertidal waders such as knot and dunlin) are not the primary terrestrial breeding bird VERs identified at the bridge site (which are predominantly passerines inhabiting scrub and woodland). While some species may overlap, the impact of habitat alteration 21 km away will not combine with the localised construction disturbance at the bridge to create a significant cumulative effect on the population as a whole.

Section Conclusion for Mostyn Dock Tidal Lagoon

8.10.19 The geographical separation and the fundamentally marine nature of the tidal lagoon project preclude any significant cumulative impact on the terrestrial habitats and species at the Dee Bridge scheme. The potential pathway via mobile species is considered insignificant. This is due to the sheer scale of the available habitat in the wider Dee Estuary and the inherent resilience of its mobile populations, which can adapt to localised changes. Furthermore, the species assemblages most affected at each location are ecologically distinct.

Conclusion of Cumulative Effects

8.10.20 For a cumulative impact to be considered significant, a clear and functional pathway must exist between projects. The assessment of the Connah's Quay Low Carbon Power project and the Mostyn Dock Tidal Lagoon has demonstrated that such pathways to the terrestrial biodiversity receptors at the A494 River Dee Bridge scheme are either absent or functionally insignificant for the following primary reasons:

- **Geographical Separation:** The substantial distances of 4.5 km and 21 km are the primary factors preventing any direct or indirect effects on the terrestrial habitats and less mobile species at the bridge site.
- **Dissimilarity of Impacts and Receptors:** The nature of the projects and their impacts are fundamentally different (localised industrial redevelopment vs. large-scale marine engineering). They affect different components of the wider ecosystem. The terrestrial VERs at the bridge, such as badgers, GCN, and bats in localised habitats, are functionally disconnected from the primary impact zones of both energy projects.
- **Resilience of Mobile Species:** For the only plausible, albeit weak, pathway involving mobile species like otters and birds, the vast scale of the Dee Estuary ecosystem provides inherent resilience. The mobility of these species allows them to utilise extensive alternative habitats, ensuring that distant and localised impacts do not translate into significant cumulative effects on the populations present at the bridge site.

8.10.21 Based on the analysis of project characteristics, geographical separation, and the absence of significant impact pathways, it is concluded with a high degree of confidence that the Connah's Quay Low Carbon Power project and the Mostyn Dock Tidal Lagoon are unlikely to result in significant cumulative adverse effects on the terrestrial biodiversity VERs identified in the vicinity of the A494 River Dee Bridge Replacement scheme.

8.11 Inter-relationships

8.11.1 In identifying and assessing the likely impacts of the proposed A494 River Dee Bridge Replacement Scheme on terrestrial biodiversity, the inter-relationships with the environmental impacts identified in other ES chapters has been considered. These include:

8.11.2 Chapter 6: Geology and Soils – Discharge of contaminated or sediment laden groundwater to the River Dee following dewatering of excavations or foundation works. Contamination of soils (including intertidal habitats), groundwater and surface water from accidental spills and leaks relating to construction plant and fuels / oils. Several measures have been highlighted within this chapter as being suitable for mitigating the potential effects. These include the protection of soil structure and quality, the protection of controlled waters from both general site works, and foundation works, and to manage contamination risks.

8.11.3 Chapter 7: Road Drainage and Water Environment – This chapter focused on the construction and operational effects of the proposed Scheme on the water quality on the River Dee and associated habitats and species, including those listed as features of interest of the designated sites. A WFD assessment has been carried out to support this ES chapter. The WFD concluded that the proposed Scheme would be unlikely to have an impact on the WFD status of the River Dee, assuming that there were no long-term impacts on sedimentation and river flow in line with the conclusions of the Hydrological Report.

8.11.4 Chapter 9: Landscape & Visual – The Environmental Masterplan (EMP) and proposed landscape works has been informed by the potential ecological effects of the Scheme on the Valued Ecological Receptors. Net gains and losses in biodiversity have been assessed and sensitive landscaping proposed to create / maintain connectivity and enhance existing biodiversity or create new habitat with biodiversity value.

8.11.5 Chapter 11: Air Quality – The modelling of changes in air quality has informed the assessment of the ecological effects on sensitive receptors, in particular the features associated with the designated sites. A qualitive assessment of potential dust effects for the proposed Scheme has been undertaken, based on the effects of receptors within 200 m of the ARN. Potential dust impacts would be suitably controlled using best practice mitigation measures. The NOx concentrations are anticipated to be below the relevant AQS objective and risks from construction dust deposition will be mitigated through the CEMP. Effects are not predicted to be significant.

8.11.6 Chapter 12: Noise and Vibration – The noise and vibration effects upon ecological receptors has been informed by assessments carried out in this Chapter. This includes the assessment of construction vibration, including piling within the River Dee. The inter-relationship between terrestrial biodiversity and noise and vibration from the Scheme primarily involves the potential for disturbance and displacement of animals from their habitats, particularly during the construction phase. Breeding and overwintering birds are vulnerable to noise, with percussive piling identified as a source of potential effects. Bats may also be deterred from their commuting and foraging routes due to noise and temporary artificial lighting, while badgers and otters also face risks of disturbance and obstruction to their movements. To mitigate these potential effects, the Scheme has incorporated several measures. During construction, Best Practicable Means (BPM) will be applied through a Construction Environmental Management Plan (CEMP), which includes using quieter equipment and ensuring its proper maintenance. Works will be sensitively timed, avoiding the bird nesting season and bat hibernation periods, with night-time activities minimised as far as practicable. Lighting designs will be implemented to reduce spill onto sensitive habitats, and quieter piling techniques such as rotary bored piles or pressed-in "silent" piling will be considered where there is close approach to noise-sensitive receptors. For birds, acoustic and visual bunds may be used to alleviate disturbance. Furthermore, 30 m exclusion zones will be set up around active badger setts, supported by pre-construction surveys. For operational noise impacts, the Scheme will utilise low noise road surfacing (Stone Mastic Asphalt) and install

a new reflective noise barrier adjacent to the westbound carriageway to provide acoustic shielding.

8.11.7 Chapter 13: Materials and Waste - During the construction and operational phase, materials and waste would be present close to the road drainage system linked to the River Dee, with potential for run off which could have ecological impacts on species and habitats and on water quality. Working methods to manage and limit these risks are set out in Chapter 19 Environmental Management.

8.11.8 Chapter 15: Climate - Future climate projections include warmer winters, hotter summers, drier summers, wetter winters, and more frequent extreme rainfall events. These climatic shifts could impact terrestrial biodiversity by reducing soil moisture, lowering river flows, increasing drought frequency, and stressing native species. Habitats like grasslands and wetlands might experience drying out, affecting species composition. There is also a risk of increased pests, diseases, and altered species migration patterns. To mitigate these potential effects, the Scheme includes a comprehensive flood risk and drainage design, which has been modelled with climate change allowances and incorporates Sustainable Drainage Systems (SuDS) to manage increased precipitation and prevent contaminants from impacting waterbodies. Standard pollution control measures will also be implemented during construction. The Scheme aims to restore and enhance habitats, such as open drains and hedgerows, with sensitive design elements, offering a beneficial effect for several species and improving resilience.

8.11.9 Chapter 16: Marine Environment - This chapter relates to the marine ecological features and provides an assessment of likely significant effects on receptors identified as being at risk from the construction, operation and maintenance of the proposed A494 River Dee bridge replacement scheme. There are close inter-relationships between this and the present terrestrial biodiversity chapter, particularly in relation to ornithology, intertidal habitats and water quality.

8.12 Residual Effects

8.12.1 The Scheme includes works within and adjacent to sites which form part of the national site network and other-designated sites and would affect habitats which support protected and notable species including bats, otters, badgers, birds and amphibians.

8.12.2 The effects on sites which form part of the national sites network would also been assessed separately in a Statement to Inform an Appropriate Assessment (SIAA).

8.12.3 This Chapter has assessed the impacts of the Scheme on VERs, taking into consideration mitigation which is an integral part of the Scheme and proposed additional mitigation, compensation or enhancements which would be incorporated into the Scheme.

8.12.4 The mitigation which is considered to be integral to the Scheme includes standard pollution and noise and vibration control measures during construction as well as sensitive lighting, to be implemented through a CEMP. These documents would ensure that design and mitigation measures would be implemented on-site by the Contractor. The CEMP would identify those responsible for implementing the various management plans. These management plans would complement and inform one another as well as require regular updates and revisions. Outline versions of these management plans have been prepared and are provided as Annexes to the Pre-CEMP in ES Chapter 18, **Appendix 18A**.

8.12.5 An Environmental Co-ordinator (ECO) would be responsible for the interface between the environmental specialists and engineers. The Environmental Clerk of Works (ECOW) would support the ECO during construction and aftercare.

8.12.6 Protected species licences would be required for works affecting bats. The licences would be obtained from NRW prior to the commencement of demolition works to the bat roosts.

8.12.7 The residual effects on VERs, described in the preceding sections of this chapter, are summarised in **Tables 8-18 – 8-20**.

Table 8-17 Summary of land take effects on Valuable Ecological Receptors (VERs)

VER	Value	Description of Effect	Effect without mitigation	Mitigation	Significance of Residual Effect
Land Take Effects					
Dee Estuary Ramsar/SPA/SAC/ SSSI	**International**	No significant land take effects The boundary of these sites is located 1.0 km downstream from the Scheme footprint and so no habitats of these sites will be directly affected by land take.	Neutral	N/A	Neutral
River Dee and Bala Lake / SAC	**International**	No effect.	N/A	N/A	Neutral
The River Dee SAC/SSSI	**International**	Loss of intertidal habitat which are features of interest. Sediment disturbance	Large adverse effect	The potential for the creation and/or enhancement of habitats in order to compensate for the loss of a small area of intertidal habitats.	large beneficial effect
Great crested newts and other amphibians	**Local**	Loss of and disturbance to terrestrial habitat	Slight adverse effect	Creation of new habitat including water bodies	slight beneficial
Badger	**Local**	Loss of foraging and commuting habitat, works in close proximity to a sett, potential for disturbance	Slight adverse effect	Pre-construction surveys for badger setts If works are within 30m of an active badger sett, a licence from NRW would be required, dependent upon the scale of disturbance. Retention and creation habitats	Neutral
Otter	**National**	Loss of and disturbance to habitat used for passage	Slight adverse effect	All habitat along the Dee will be reinstated post works and passage within the River Dee itself will be maintained.	Neutral
Terrestrial breeding birds	**County**	Loss of nesting habitat and foraging habitat	Slight adverse effect	Works will be timed so as to avoid the removal of vegetation within the nesting bird season or checks by an ecologist will be made prior to clearance. The Scheme will incorporate landscaping which will provide a suitable habitat for nesting.	Neutral
Terrestrial overwintering birds	**County**	Loss of or disturbance to small areas of land used for roosting / foraging	Slight adverse effect	Habitat would be reinstated, and large expanses of intertidal habitats left untouched.	Neutral
Bats	**Local**	Loss of habitat, destruction of a roosts	Slight adverse effect	Mitigation for the loss of the roosts would be provided in the form of a pole-mounted bat boxes	Neutral

VER	Value	Description of Effect	Effect without mitigation	Mitigation	Significance of Residual Effect
		risks of mortality and temporary habitat fragmentation.		and the creation of a new roost building. In addition, combined summer / winter bat boxes would be installed within or on existing or new structures and on trees to be retained. Restoration and creation of habitat.	

Table 8-18 Summary of construction effects on Valuable Ecological Receptors (VERs)

VER	Value	Description of Effect	Effect without mitigation	Mitigation	Significance of Residual Effect
Construction effects					
Dee Estuary Ramsar/SPA/SAC/ SSSI	**International**	Indirect pollution incidents leading to changes in water quality and increased siltation. Disturbance to habitats.	Moderate adverse effect	Construction and demolition methods including piling methods to reduce the disturbance of silt and noise for in-river works and associated habitats. Pollution, silt mobilisation and noise control measures which are integral to the Scheme as described in the CEMP.	Neutral
River Dee and Bala Lake / SAC	**International**	Indirect pollution incidents leading to changes in water quality and increased siltation. Disturbance to habitats	Moderate adverse effect	Construction and demolition methods including piling methods to reduce the disturbance of silt and noise for in-river works and associated habitats. Pollution, silt mobilisation and noise control measures which are integral to the Scheme as described in the CEMP.	Neutral
The River Dee SAC/SSSI	**International**	Pollution including Air pollution. Loss of, and disturbance to, habitats which are a feature of the SSSI and SAC. Disturbance to habitats.	Moderate adverse effect	Construction and demolition methods including piling methods to reduce the disturbance of silt and noise for in-river works and associated habitats. Pollution, silt mobilisation and noise control measures which are integral to the Scheme as described in the CEMP. The potential for the creation and/or enhancement of habitats in order to compensate for the loss of a small area of intertidal habitats.	Neutral
Great crested newts and other amphibians	**Local**	Direct mortality during site preparation and clearance, passing construction traffic and dewatering activities for the Queensferry Drain	Slight adverse effect	Reasonable Avoidance Measures for great crested newts would be set out within the CEMP. This includes the presence of an ecologist during site clearance to conduct a site walkover of habitat with the potential to support amphibians, stage strimming of vegetation before clearance and ecological supervision of the draining of the Queensferry Drain.	Neutral
Badger	**Local**	Direct mortality during site preparation and clearance and from construction traffic, disturbance during construction including increased lighting.	Slight adverse effect	Reasonable Avoidance Measures for badgers would be set out within the CEMP. An exclusion zone would be set up around active setts of a buffer of 30m. The line of the new road and other areas, such as contractors' compounds etc, will be re-surveyed within 3 months prior to construction and immediately before to update the original survey and to ensure that no setts have been created in the interim period which may be disturbed / destroyed as a result of	Neutral

VER	Value	Description of Effect	Effect without mitigation	Mitigation	Significance of Residual Effect
				construction. Mitigation will be adjusted as necessary. Maintain darkness at setts, paths and crossings by setting back compounds, aiming luminaires away from vegetated corridors, and using shielding (baffles/hoods/louvres). Restrict lighting to working hours; switch off otherwise, with PIR security or IR where feasible. Verify levels against ILP GN01 using PLG04, adjust, and secure through the CEMP.	
Otter	**National**	Disturbance, obstruction to movement. Increased lighting.	Slight adverse effect	Reasonable Avoidance Measures for otters include the installation of a means of escape to any deep excavations (>0.5m) left open overnight, site walkovers and inspections, maintenance of access within the Dee. Sensitive lighting if works required overnight. Maintain dark shorelines by aiming lights away from water and haul-outs, using rear shields and switching off when idle. Confine reactive works at Queensferry Drain to tightly focused task lighting; schedule routine tasks in daylight. Use motion-activated, short-timer security lighting. Implement GN01-compliant design, monitoring and CEMP-led adjustments. Piling methods to reduce the disturbance of silt and noise for in-river works.	Neutral
Terrestrial breeding birds	**County**	Displacement and disturbance from vibration, noise, increased lighting and an increase in human activity. Increased sediment and dust indirectly impacting foraging habitat. Abandonment of nests. Damage and/or destroy active nests.	Slight adverse effect	Construction and demolition methods including piling methods to reduce the disturbance of silt and noise for in-river works and intertidal areas. Pollution and noise control measures which are integral to the Scheme as described in the CEMP. Sensitive lighting if works required overnight. Temporary screening if required, provided around the immediate Scheme footprint to lessen visual impacts and dampen acoustic disturbance during the breeding season (March to September). Preconstruction nesting bird checks would be completed by a suitably experienced ornithologist prior to the works taking place.	Neutral
Terrestrial overwintering birds	**County**	Displacement from noise, increased sediment impacting	Slight adverse effect	Construction and demolition methods including piling methods to reduce the disturbance of silt and noise for in-river works and intertidal areas.	Neutral

VER	Value	Description of Effect	Effect without mitigation	Mitigation	Significance of Residual Effect
		foraging habitat. Visual intrusion.		Pollution and noise control measures which are integral to the Scheme as described in the CEMP. Where unavoidable, anticipated nosier construction activities should be completed during three hours either side of high tide in order for species to utilise the banks during low tide in order to both commute and/or forage. Sensitive lighting if works required overnight.	
Bats	**Local**	Temporary lighting and increased disturbance from construction traffic and noise.	Slight adverse effect	Reasonable avoidance measures as set out within approved derogation licence to include pre-demolition surveys and inspection, site supervision during demolition, seasonal constraints and minimising working at night during seasons of bat activity. Preserve dark roost access, commuting and foraging corridors by siting/aiming task lights away from treelines and riparian edges. Enforce strict switch-off outside work hours, with PIR security lighting. Use warmer white sources and shielding to minimise spill/skyglow (GN01), design to ILP/BCT GN08, verify via calculations and on-site monitoring.	Neutral

Table 8-19 Summary of operational effects on Valuable Ecological Receptors (VERs)

VER	Value	Description of Effect	Effect without mitigation	Mitigation	Significance of Residual Effect
Operational effects					
Dee Estuary Ramsar/SPA/SAC/ SSSI	**International**	Indirect effects from increased toxicity levels from road run-off.	Moderate adverse effect	Highway drainage and run off from adjacent land would be collected by piped highway drainage systems. These would continue to discharge into the Queensferry Drain at locations near the railway and outfall into the River Dee. Protection from accidental spillages would be provided by isolation systems allowing pollutants to be contained for safe disposal.	Neutral
River Dee and Bala Lake/SAC	**International**	Indirect effects from increased toxicity levels from road run-off	Moderate adverse effect	As above	Neutral
The River Dee SAC/SSSI	**International**	Indirect effects from increased toxicity levels from road run-off. Air pollution. Loss of habitat from shading effects.	Moderate adverse effect	Highway drainage and run off from adjacent land would be collected by piped highway drainage systems. These would continue to discharge into the Queensferry Drain at locations near the railway and outfall into the River Dee. Protection from accidental spillages would be provided by isolation systems allowing pollutants to be contained for safe disposal. The mitigation included in the Scheme for the loss of saltmarsh and intertidal habitats arising from land take and from operational shading is in discuss on with NRW. This includes the potential for the creation and/or enhancement of habitats in order to compensate for the loss of a small area of saltmarsh. The shading effects of the new replacement bridge will be mitigated for in the long term by the removal of the existing bridge.	Neutral
Great crested newts and other amphibians	**Local**	Increased toxicity levels from road run-off entering drains. Entrapment in gully pots	Slight adverse effect	Highway drainage and run off from adjacent land would be collected by piped highway drainage systems. These would continue to discharge into the Queensferry Drain at locations near the railway and outfall into the River Dee. Protection from accidental spillages would be provided by isolation systems allowing pollutants to be contained for safe disposal.	Slight beneficial

VER	Value	Description of Effect	Effect without mitigation	Mitigation	Significance of Residual Effect
				Creation and enhancement of drains and SuDS ponds for biodiversity and landscape planting for connectivity. Sensitive lighting designs. Where there is the potential to incorporate amphibian friendly drainage detail, for example wildlife kerbs[80] and modified gully pots or kerb design, this should be instigated as an added mitigation measure.	
Badger	**Local**	Operational lighting raises brightness, spill and glare, delaying emergence, compressing activity and deterring crossings; headlight sweeps and motion-triggered security lights can startle, causing local avoidance near columns and entrances.	Slight adverse effect	Setts and routes kept dark via integral shields, zero-uplight, warmer sources and carriageway-focused aiming. Limit security lighting to short, motion-activated (IR where feasible); schedule pumping-station maintenance in daylight. Use constant-light-output and permanent dimming; evidence GN01 compliance and verify/adjust on site with PLG04. Habitat creation.	Neutral
Otter	**National**	Operational lighting near abutments, paths and access points can deter shoreline movement, reduce haul-out use, and delay passage; glare/reflections amplify brightness, with occasional task lights causing short-reach displacement.	Slight adverse effect	Maintain dark river margins using directional optics, back-light control and rear shields on riverside columns. Keep pumping-station lighting off unless tightly bounded task use; schedule routine maintenance in daylight. Use motion-activated/infrared security lighting. Ensure GN01 compliance, re-assess if designs change, and verify low riverside illuminance via periodic PLG04 measurements. Habitat creation.	Neutral
Terrestrial breeding birds	**County**	Disturbance and displacement from increased lighting	Slight adverse effect	Sensitive lighting and planting design.	Neutral
Terrestrial overwintering birds	**County**	Disturbance and displacement from increased lighting	Slight adverse effect	Instigation of sensitive, reduced or an avoidance of additional lighting, in particular where this affects watercourse and associated banks.	Neutral
Bats	**Local**	Operational light spill to treelines and river	Slight adverse effect	Application of ILP/BCT GN08 and GN01: use warm (≤2700–3000 K), 0%-uplight/Dark Sky	Neutral

[80] Available at Wildlife Kerb | Aco Wildlife Kerb [Accessed 01/04/2025]

VER	Value	Description of Effect	Effect without mitigation	Mitigation	Significance of Residual Effect
		creates partial barriers, delaying emergence, diverting flightlines, reducing under-bridge crossings (especially light-averse species) and redistributing prey.		optics with integral/back-light shields and careful aiming to keep roost access, treelines and riparian edges dark; confine pumping-station task lighting and schedule routine work in daylight; evidence via calculations and verify with PLG04 monitoring.	

8.13 Summary of Residual Effects

8.13.1 The residual effects of land take on the sensitive receptors with mitigation in place are assessed as being either neutral or beneficial.

8.13.2 Great crested newts and other amphibians experienced habitat loss as a result of land take. This would be mitigated by creating new habitats, as well as the retention of existing habitats, resulting in a slight beneficial residual effect. Badgers, otters, breeding birds, overwintering birds, and bats faced habitat loss or disturbance, with mitigation measures such as habitat creation, reinstatement, and ecological checks, leading to neutral residual land take effects for these species.

8.13.3 For the protected and notable species great crested newts, badgers, otters, breeding birds, overwintering birds, and bats, slight adverse effects are anticipated from construction and demolition. These will be mitigated through reasonable avoidance measures, including ecological supervision, sensitive lighting, and pre-construction surveys, aiming to reduce or avoid any residual effects from construction and demolition activities.

8.13.4 The residual operational effects on the Dee Estuary, River Dee, and associated habitats due to potential increased toxicity levels from road run-off are expected to be moderate adverse. Mitigation measures, including highway drainage systems and isolation systems for accidental spillages, aim to neutralise these residual effects during the operation of the road.

8.13.5 For the protected and notable species great crested newts, badgers, otters, breeding birds, overwintering birds, and bats, slight adverse effects are anticipated mainly due to potential increased lighting. Mitigation measures include sensitive lighting designs, habitat creation, and specific measures, where possible, to include amphibian friendly kerbs and modified gully pots to ensure neutral residual effects.

8.13.6 Over time, replacement planting would establish and provide continued connectivity and habitat for a range of species, in line with relevant Acts and Policies to retain/create/enhance resilient ecosystems and retain connectivity.

8.13.7 The purpose of the Scheme is to replace the existing bridge that is deteriorating and causing an increasing risk to the operation of the A494 and the strategic road network. The existing bridge crosses the highly protected River Dee and therefore the replacement of the bridge would not only safeguard the future of the strategic road network but also reduce the environmental risks to the River Dee.

8.13.8 The extent of the Scheme is highly restricted by having to re-connect to the existing alignment of the A494 on either side of the river. The construction of the replacement bridge has an unavoidable effect on the banks of the River Dee and the protected saltmarsh habitat and intertidal areas on both banks. However, the removal of the existing bridge provides opportunity for the saltmarsh to naturally recolonise on both banks of the river, previously shaded by the bridge. In addition, an area on the south bank of the River Dee further downstream has been identified where enhancements to the existing saltmarsh habitat can be improved as part of the Scheme proposals.

8.13.9 The Scheme incorporates sufficient land take to deliver net biodiversity benefits in the form of increased terrestrial habitat by providing species rich grassland and native species hedgerows that would be managed in the long term as soft estate and as part of the strategic road network. The Scheme also delivers an increased length of open channel watercourses and bankside habitat along the south-eastern side of the A494 road corridor.

8.13.10 The Scheme would leave the existing environment in a better state than currently exists by safeguarding the protected River Dee and replacing areas of dereliction with terrestrial habitat that would be maintained and managed in the long term as soft estate and part of the wider strategic road network.

Llywodraeth Cymru / Welsh Government

A494 RIVER DEE BRIDGE REPLACEMENT SCHEME

Environmental Statement

Volume 1: Technical Assessment Report

Chapter 9: Landscape and Visual Impact

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9. Landscape and Visual Impact

9.1 Introduction

9.1.1 This chapter presents the findings of the Landscape and Visual Impact Assessment (LVIA), carried out for the Scheme, which includes an assessment of townscape.

9.1.2 The European Landscape Convention 2000 defines 'Landscape' as '...an area perceived by people, whose character is the result of natural and/or human factors.

9.1.3 The Scheme is described in Environmental Statement (ES) Chapter 2. Key impacts and effects considered within this chapter include the following:

a) Direct physical changes to the landscape in terms of landform and surface elements, fragmentation of landscape features or designated areas and the introduction of moving vehicles.

b) Indirect effects on the character and quality of the landscape in terms of change in the perception of the landscape through the introduction of new landscape elements.

c) Direct day time and nighttime effects on the amenity of visual receptors in terms of the change in view.

d) Indirect effects on views and visual receptors in terms of change to public attitude and behaviour towards the use of a place.

9.1.4 This chapter presents the legislation and policy context, describes and evaluates the baseline landscape resource, views and visual amenity of visual receptors within a study area defined by a Zone of Theoretical Visibility (ZTV) and considers the expected change brought about by the Scheme during construction and operation, and during day and night. The significance of the identified effect is identified in terms of change to land use, loss of landscape features, and the scale and duration of the Scheme within views.

9.1.5 This chapter includes a combination of desk study review and field work during 2024 and 2025. Field work was carried out when vegetation was in full leaf during Summer 2024, with a second visit when deciduous trees and shrubs were leafless during Winter 2024. Further site visits were made in 2025 to review specific receptor impacts and to take photographs from key viewpoints.

9.1.6 Mitigation has been assessed as part of an iterative design and assessment process. The design approach is described in Section 9.5 of this chapter. This chapter should be read together with Figures 9.1 to 9.10 in ES Volume 2, and Appendices 9A to 9E in ES Volume 3. The Environmental Masterplan is presented in Figures 2.3A-D in Volume 2.

9.2 Legislation and Policy Framework

9.2.1 A review of topic-specific published landscape and townscape policies and guidance has been carried out to inform this assessment and mitigation strategy. The following section summarises the relevant legislation and policy context.

Relevant legislation

9.2.2 The following legislation, including subsequent amendments, is relevant to the scheme and has been considered:

a) National Parks and Access to the Countryside Act 1949.
b) The Countryside and Rights of Way (CRoW) Act 2000.
c) Wildlife and Countryside Act 1981.
d) The Natural Environment and Rural Communities (NERC) Act 2006.
e) Hedgerows Regulations 1997.
f) Well-being of Future Generations Act 2015.
g) Environment (Wales) Act (2016).
h) The Green Corridors on the Welsh Government Trunk Road and Motorway Network Initiative (2018).

National Planning Policy

9.2.3 The current land use planning policies for the Welsh Government are set out in Planning Policy Wales Edition 12 (February 2024). The principal chapter of relevance to LVIA is Chapter 6 ‘Distinctive and Natural Places’, which includes policies relating to the protection and enhancement of biodiversity, which must be considered alongside the need to meet social and economic objectives and the need of local communities.

9.2.4 Planning Policy Wales (PPW) also supports the use of Natural Resources Wales' LANDMAP data system as an important information resource. LANDMAP describes and evaluates the physical, ecological, visual, cultural and historic aspects of the landscapes of Wales, and provides the basis of a consistent, quality assured national approach to landscape assessment.

9.2.5 PPW is supplemented by a series of topic-based Technical Advice Notes (TANs). The relevant TANs include the following:

a) TAN10 *Tree Preservation Orders* provides guidance on where local planning authorities are to make adequate provision for the preservation and planting of trees when granting planning permission, through the process of making Tree Preservation Orders (TPO).

b) TAN 12 *Design* provides guidance on how good design should be achieved through the planning process.

9.2.6 Procedural guidance relevant to LVIA is provided in Welsh Government Circulars, including the following:

a) Welsh Office Circular 5/93 *Public Rights of Way* (Department of the Environment, Welsh Office 1993.

b) National Assembly for Wales (2002) Circular 30/01 *Countryside and Rights of Way Act* (2000).

9.2.7 Future Wales: The National Plan 2040 is the Welsh Government's development plan for addressing key national priorities through the planning system. It is a spatial plan that sets a direction for where investment in infrastructure and development benefits Wales, influenced by the Well-being of future Generations (Wales) Act 2015. Policy 20 - *National Growth Area Wrexham and Deeside* states that Wrexham and Deeside will be the main focus for growth and investment in the north region.

Local Planning Policy

9.2.8 Flintshire County Council (FCC) adopted their Local Development Plan 2015-2030 (FLDP) in January 2023 and this plan will be considered within the ES.

9.2.9 Strategic policy STR13 *Natural and Built Environment, Green Networks and Infrastructure* requires that development should identify, protect, enhance and connect Flintshire's environmental assets and should:

a) Protect open countryside and the undeveloped coastline.

b) Protect the open character and appearance of green wedges.

c) Conserve, protect and enhance the quality and diversity of Flintshire's natural environment including landscape and biodiversity.

d) Promote opportunities to enhance biodiversity and ensure resilience.

e) Maintain, enhance and contribute to green infrastructure.

f) Create and protect green spaces and open space / play environments that encourage and support good health, well-being and equality.

9.2.10 This policy acknowledges the inherent qualities of Flintshire's countryside and coastline and seeks to preserve and improve the natural environment and local scenery. Additionally, it focuses on safeguarding natural elements and green areas in urban settings.

9.2.11 Development management policy EN2 *Green Infrastructure* requires that the quality and connectivity of the green infrastructure network, including designated and non-designated green spaces, are protected and enhanced. Where appropriate new linkages should be created from the proposed development to the existing local network.

9.2.12 Policy EN4: *Landscape Character* requires that new development should not significantly harm the character and appearance of the landscape. Landscaping and other mitigation efforts should aim to lessen the impact on the landscape and, where feasible, provide enhancement.

9.2.13 Policy EN7 *Development Affecting Trees, Woodlands and Hedgerows* requires that new development will not be permitted if it causes significant loss to trees, woodland or hedgerows of biodiversity, historic or amenity value. Where removal of trees is necessary to enable development, suitable replacements shall be provided within the site to produce a net benefit to biodiversity.

9.2.14 Policy EN11 *Green Wedges* requires that the openness of designated areas of countryside between and around settlements be retained in order to prevent the

coalescence of towns with other settlements and encourage the redevelopment of derelict land within urban areas. Transport infrastructure developments may be appropriate in green wedges provided its openness is preserved.

Neighbouring Authorities

9.2.15 Parts of the Scheme may be visible from the neighbouring authority of Cheshire West and Chester Council (CWCC), with potential for distant views of new structures. The *Cheshire West and Chester Local Plan* was adopted in January 2015. The Council has agreed to prepare a new Local Plan under the provisions of the Levelling Up and Regeneration Act 2023, but until a new Local Plan has been completed the Adopted Local Plan will continue to operate.

9.3 Assessment Methodology

Relevant Guidance

9.3.1 This LVIA has been carried out in accordance with methodology set out within Standards for Highways Design Manual for Roads and Bridges (DMRB) LA104 *Environmental assessment and monitoring*, and LA107 *Landscape and visual effects*.

9.3.2 Other relevant guidance documents referred to include:

a) *Guidelines for Landscape and Visual Impact Assessment*, Third Edition (GLVIA3) Landscape Institute (LI) and Institute of Environmental management and Assessment (IEMA) (2013).

b) LI Technical Information Note 08/2015 *Landscape Character Assessment* (2016).

c) LI Technical Information Note 05/2017 *Townscape Character Assessment* (2017).

d) LI Technical Guidance Note 06/2019 *Visual Representation of Development Proposals* (2019).

e) LI Technical Guidance Note 01/2024 *Notes and Clarifications on Aspects of GLVIA3* (2024).

f) Countryside Council for Wales and Land Use Consultants *Landscape Character Map for Wales*.

g) Natural Resources Wales (NRW) LANDMAP dataset and Guidance Note 46 *Using LANDMAP in Landscape and Visual Impact Assessments*.

Review of Previous Work

9.3.3 Welsh Government have been investigating solutions to improve road safety and traffic flow for the A494 corridor at Deeside for many years. Previous studies include:

a) A494 Drome Corner to Ewloe Improvement (2006).

b) A55 / A494 / A548 Deeside Corridor Improvement (2017).

c) A494 River Dee Bridge Improvement (2019-2021).

Study Area

9.3.4 In accordance with LA107, a search area is identified for LVIA to include the area from which the Scheme with traffic would influence. This search area is based on a Zone of Theoretical Visibility (ZTV) created using GIS software and Ordnance Survey height data.

9.3.5 Field work is then carried out to refine the search area to identify the study area where potentially significant effects upon landscape character, views and visual amenity are likely to occur as a result of changes brought about by the Scheme.

9.3.6 Representative viewpoints are selected to assess the effect of the Scheme on landscape character areas. These have been selected to represent a range of directions and distances. Viewpoints can be accessed from public roads and Rights of Way or open space. Existing surface features such as buildings and substantial vegetation limit the locations with a clear and uninterrupted view.

Approach to Identification of Baseline Conditions

9.3.7 As part of the desk study, a review of the landscape resource and topography within the study area is carried out to establish the regional and local landscape character, with reference to the following published sources:

a) National Landscape Character Areas (NLCA), NRW.

b) LANDMAP, dataset maintained by NRW.

c) National and Local planning policy (as outlined in section 9.2).

d) OSGB (OS) Landranger Maps and Explorer Maps (small scale), and OS MasterMap (large scale).

e) Aerial imagery (ortho-rectified and oblique).

f) OS height data and Welsh Government LiDAR data.

9.3.8 Landscape character is a combination of geology, soils, landform, vegetation, field patterns, land use and settlement. Wales is divided into 48 broad national-scale character areas. The Scheme is located within NLCA 13 – Deeside and Wrexham.

9.3.9 LANDMAP further divides Wales into geographical areas identified by their own landscape characteristics and qualities. There are 5 datasets (or aspects). These are *Geological Landscape*, *Landscape Habitat*, *Visual and Sensory*, *Historic Landscape* and *Cultural Landscape Services*. Each aspect area has been evaluated in a nationally consistent set.

9.3.10 CWCC have produced a landscape strategy incorporating the regional landscape character types within the local authority area. Main urban areas are not included. Each landscape character type is further divided into local character areas and guidance is provided for the conservation, enhancement and restoration of the landscape. There is no evaluation but an overall landscape management strategy is given.

9.3.11 Information contained within the 5 aspect layers of LANDMAP combined with field work, define Landscape Character Area (LCA) boundaries, which are taken forward for assessment. The LCAs that are within the study area are identified by:

a) Organising the landscape into areas of distinct, consistent and recognisable character.

b) Describing the key characteristics such as landcover and pattern, scale and appearance, human interaction and tranquillity, sense of place and scenic quality, seasonal interest, and night-time activities.

c) Assessing their condition and quality.

d) Judging importance or value, which considers any landscape, ecological or cultural heritage designations, and any assets of local significance without designation that may be valued by local communities.

e) Considering their ability to accommodate change of the type proposed without unjustifiable change to the baseline condition and/or the achievement of landscape strategies and policies.

9.3.12 The visual baseline assessment describes specific or general views of the study area that may be changed by the Scheme as experienced by people. To establish a visual baseline, a review of the visual resource and topography within the study area is carried out as part of the desk study, with reference to the following relevant published sources:

a) OS Explorer small-scale mapping.

b) OS MasterMap large scale mapping.

c) Aerial imagery.

d) Urban Tree and National Forest Inventory datasets (NRW).

9.3.13 Potential screening features including buildings, structures and substantial vegetation are identified during this process together with potential visual receptors such as residential and business properties, recreational areas and public rights of way.

9.3.14 Field work is carried out when deciduous trees are in full leaf and when they have dropped their leaves. It identifies the number and type of properties and places where people would experience a change in view, the nature of the view and the activity and sensitivity of the viewer.

Consultations

9.3.15 During the ES process, consultation with stakeholders has taken place through the Environmental Liaison Group. Consultation included the agreement of LVIA methodology, the extent of the LVIA study area, the identification of visual receptors, location of representative viewpoints and the requirements for mitigation.

Assessment Criteria and Assessment of Significance

Landscape receptors

9.3.16 The sensitivity of a landscape is a combination of judgements of a character area's ability to accommodate change of the type proposed (in this case modification to an

existing highway with its associated forms and infrastructure), and the value of the character area as established during the baseline assessment. The combination of judgments is based on the physical condition of the landscape and the value attached to it, often based on designation or recognition as expressed by national or local consensus.

9.3.17 The criteria used to assess the sensitivity of each LCA is set out in Table 9-1.

Table 9-1 Landscape sensitivity (susceptibility and value)

Landscape sensitivity of receptor	Typical description
Very high	Landscapes of very high international or national importance and rarity or value with no or very limited ability to accommodate change without substantial loss or gain (i.e. National Parks and internationally acclaimed landscapes such as UNESCO World Heritage Sites).
High	Landscapes of high national importance containing distinctive features or elements with limited ability to accommodate change without incurring substantial loss or gain (i.e. designated areas such as Registered Parks and Gardens and Country Parks).
Medium	Landscapes of local or regional recognition or importance able to accommodate some change (i.e. features worthy of conservation).
Low	Local landscape areas or receptors of low to medium importance with ability to accommodate change (i.e. non-designated or designated areas of local recognition).
Negligible	Landscapes of very low importance and rarity able to accommodate change.

9.3.18 The relevant LANDMAP character areas, across each of the five aspect layers and the CWCC Landscape Strategy areas that overlap the LCAs, have been identified

and are presented within Appendix 9-A and 9-B. The evaluations attached to the LANDMAP aspect areas are included and are used to inform the judgement of the sensitivity of the LCAs.

9.3.19 The criteria used to assess the landscape sensitivity are based on LA107 Table 3.22.

9.3.20 Impacts are graded according to their scale and magnitude. The following aspects are used to determine the magnitude of landscape impact.

a) The size or scale of the impact i.e., the quantity of landscape elements that would be affected, and the proportion that this represents within a character area or the extent of the view that would be changed and whether the changes affect key characteristics of the landscape or views.

b) Geographical extent i.e., the area that the project would influence.

c) Duration and reversibility of impact i.e., whether the impact is short term to long-term and whether the impact is permanent or can be reversed to original condition.

9.3.21 The magnitude of impact is rated to a five-point scale of major, moderate, minor, negligible and no change. Magnitude can be assessed as adverse or beneficial. Terms used to describe magnitude of landscape impacts are presented in Table 9-2.

Table 9-2 Magnitude and nature of effect on the landscape

Magnitude of effect (change)		Typical description
Major	Adverse	Total loss or large-scale damage to existing landscape character or distinctive features or elements; and/or addition of new uncharacteristic, conspicuous features or elements (i.e. road infrastructure).
	Beneficial	Large scale improvement of landscape character to features and elements; and/or addition of new distinctive features or elements, or removal of conspicuous road infrastructure elements.

Magnitude of effect (change)		Typical description
Moderate	Adverse	Partial loss or noticeable damage to existing landscape character or distinctive features or elements, or addition of new uncharacteristic, noticeable features or elements (i.e. road infrastructure).
	Beneficial	Partial or noticeable improvement of landscape character by restoration of existing features or elements; or addition of new characteristic features or elements or removal of noticeable features or elements.
Minor	Adverse	Slight loss or damage to existing landscape character of one (maybe more) key features and elements; and/or the addition of new uncharacteristic features and elements.
	Beneficial	Slight improvement of landscape character by the restoration of one (maybe more) key existing features and elements; and/or the addition of new characteristic features.
Negligible	Adverse	Very minor loss, damage or alteration to existing landscape character of one or more features and elements.
	Beneficial	Very minor noticeable improvement of character by the restoration of one or more existing features and elements.
No change		No noticeable alteration or improvement, temporary or permanent, of landscape character of existing features and elements.

9.3.22 The criteria used to assess the landscape magnitude of effect are based on LA107 Table 3.24.

Visual receptors

9.3.23 The sensitivity of the visual receptor is a judgment of the type of change to views and visual amenity brought about by the project combined with the activity of the viewer.

9.3.24 Visual amenity receptors or people engaging in certain activities are identified during desk study assessment and are verified during field work. The extent and nature of their views are described, and the sensitivity of the receptors defined.

9.3.25 Visual receptors are categorised by their sensitivity, which is the occupation or activity of people experiencing the view in specific locations and the extent to which their attention or interest may be focused on the views. The criteria used to assess visual receptor sensitivity are presented in Table 9-3.

Table 9-3 Visual sensitivity (susceptibility and value)

Sensitivity (susceptibility and value)	Typical description
Very high	Static view from and of major tourist attractions. Views from and of very important national or international landscapes, cultural or historic sites (e.g. National Parks or UNESCO World Heritage Sites). Receptors engaged in specific activities for enjoyment of dark skies.

Sensitivity (susceptibility and value)	Typical description
High	Transient views by users of nationally promoted Public Rights of Way and recreational trails (e.g. National Trails, long distance routes). Views by users of public open spaces for the enjoyment of the countryside (e.g. Country Parks). Static views from dense residential areas, longer transient views from designated public open space or recreational areas. Views from and of rare designated landscapes of national importance.
Moderate	Static views from less densely populated residential areas, schools and other institutional buildings and their outdoor areas. Views by outdoor workers. Transient views from local or regional areas such as public open space, scenic roads and railways or waterways, users of local or regional designated tourist routes of moderate importance. Views from and of landscapes of regional importance.
Low	Views by users of main roads or passengers in public transport on main arterial routes. Views by indoor workers. Views by users of recreational or formal sports facilities where the landscape is secondary to the enjoyment of the sport. Views by users of local public open space of limited importance with limited variety or distinctiveness.
Negligible	Quick transient views such as from fast moving vehicles. Views from industrial areas or land awaiting development. Views from landscapes of no importance with no variety or distinctiveness.

9.3.26 Selected representative viewpoints are presented in Appendix 9-C and a schedule of the visual receptors is presented in Appendix 9-D.

9.3.27 The criteria used to assess the landscape sensitivity are based on LA107 Table 3.41.

9.3.28 Visual impacts are graded according to their scale and magnitude. The following aspects are used to determine the magnitude of visual impact.

a) Scale of change.
b) Nature of change.
c) Duration of change.
d) Distance.
e) Screening.
f) Direction and focus of view.
g) Winter Year 1 (opening year), Summer and Winter Year 15 (design year).
h) Removal of existing mitigation or vegetation.
i) Activity of visual receptor (static or transient).

9.3.29 The magnitude of impact is rated to a five-point scale of major, moderate, minor, negligible and no change. Magnitude can be assessed as adverse or beneficial. Terms used to describe magnitude of visual impacts are presented in Table 9-4.

Table 9-4 Magnitude (change) of visual effect

Magnitude (change) of visual effect	Typical description
Major	The Scheme, or part of it, would become the dominant feature or focal point of the view.
Moderate	The Scheme, or part of it, would form a noticeable feature or element of the view that is readily apparent to the receptor.

Magnitude (change) of visual effect	Typical description
Minor	The Scheme, or part of it, would be perceptible but not alter the overall balance of features and elements that comprise the existing view.
Negligible	Only a very small part of the Scheme work or activity would be discernible, or being at such a distance it would form a barely noticeable feature or element of the view.
No change	No part of the Scheme work or activity would be discernible.

9.3.30 The criteria used to assess the visual magnitude of effect are based on LA107 Table 3.43.

Significance of effect

9.3.31 The sensitivity of the receiving landscape or visual receptor and magnitude of impact are combined to establish the significance of effect. This is expressed as a scale ranging from Very large to Neutral. The scale can be both negative (adverse) or positive (beneficial). The significance of effect is derived using the matrix presented in Table 9-5, which is based on LA104 Table 3.8.1.

Table 9-5 Significance matrix

		Magnitude of impact (degree of change)				
		No change	Negligible	Minor	Moderate	Major
Sensitivity of receptor	Very high	Neutral	Slight	Moderate or Large	Large or Very Large	Very Large
	High	Neutral	Slight	Slight or Moderate	Moderate or Large	Large or Very Large
	Medium	Neutral	Neutral or Slight	Slight	Moderate	Moderate or Large

	Magnitude of impact (degree of change)				
	No change	Negligible	Minor	Moderate	Major
Low	Neutral	Neutral or Slight	Neutral or Slight	Slight	Slight or Moderate
Negligible	Neutral	Neutral	Neutral or Slight	Neutral or Slight	Slight

9.3.32 Significant effects typically comprise residual effects that are within the moderate, large or very large category. Descriptions for significance are set out in Table 9-6.

Table 9-6 Significance categories

Significance category	Typical description
Very large	Effects at this level are material in the decision-making process.
Large	Effects at this level are likely to be material in the decision-making process.
Moderate	Effects at this level can be considered to be material decision-making factors.
Slight	Effects at this level are not material in the decision-making process.
Neutral	No effects or those that are beneath levels of perception, within normal bounds of variation or within the margin of forecasting error.

9.3.33 The descriptions of significance of effect are based on LA104 Table 3.7.

Limitations of the assessment

9.3.34 The LVIA has been carried out from publicly accessible locations in a built-up area without the need for direct access to private land or residential premises or business properties. To ensure a robust assessment, the following measures have been taken.

a) Use of a combination of OS height data and Welsh Government LiDAR to construct a digital terrain model (DTM) for the production of the ZTV.

b) Use of large-scale OS mapping and topographic survey data to determine land cover and the location of features that would screen the influence of the Scheme.

c) Field surveys to verify ZTV output and to assess views available from public open space, land with public access and Public Rights of Way.

d) Assessment of seasonal and night-time variation.

9.4 Baseline Conditions

Landscape baseline

Landscape designations

9.4.1 The study area overlaps some protected designations which reflect the importance of the River Dee, the Dee Estuary and the coastal slopes for their ecological and cultural value. Nature conservation designations are considered in Chapter 8. Archaeology and Cultural Heritage designations are considered in Chapter 10. Designations, including geological, nature conservation, landscape and cultural heritage, are included within Figures 9.3 to 9.6.

9.4.2 Shotton Steelworks Garden (PG1) is a Grade II Registered Historic Park and Garden (RHPG). A formal garden and forecourt associated with the office and support buildings of Shotton Steelworks, designed in the mid C20 by Sylvia Crowe. It occupies level ground next to the canalised River Dee and the Wrexham-Bidston railway. Trees around the garden boundaries limit views out.

9.4.3 Hawarden Castle (PG2) is Grade I RHPG. The landscape park, semi-formal and informal gardens include a ruined medieval castle as a focal point. The park features designed elements from the early C18, through the late C19. Woodland and parkland trees are a prominent feature of this park, limiting the locations with views of the surrounding area.

9.4.4 Part of Hawarden village is designated as a Conservation Area (CA). Included are properties along The Highway, St Deiniols Church and grounds, The Old Rectory library and grounds and Gladstone's Library and grounds.

9.4.5 Shotwick is a hamlet on ground sloping gently down to the natural course of the Dee, clustered around a short, wide street. Before the canalisation of the Dee in the C18, and after the original Dee silted up making navigation to Chester difficult, Shotwick took the place of Chester as the major port. It is also the location of a ford and ferry on the historic trading route/military way between Cheshire and north Wales.

Regional landscape character

9.4.6 The Scheme is located within NLCA13 Deeside and Wrexham13. Key characteristics relevant to the study area include the following:

a) Lowland foothills and levels – sloping down to lower Dee and Dee Estuary.

b) A single large river, the Dee, traverses the area – the Dee opens out into a broad estuary with tidal sand and mud flats.

c) A broad flat flood plain adjacent to the Dee Estuary – with wide open views to the Wirral.

d) Mixed pasture and some arable – and farm woodland cover.

e) Urban settlements – a strongly settled character is apparent in the central part of the area.

f) An industrial character – evident in the coalesced settlements at Connah's Quay, associated with both the Chester and Holyhead railway line, mining and large-scale power generation and industrial plants. Includes landmark-scale structures such as Broughton Aircraft Factory, Shotton Steelworks and Connah's Quay Power Station.

g) Small settlements – outside urban areas, compact villages associated with coalesced ribbon developments and encroachment upon commons, the legacy of former coal and lead mining industries.

h) Culturally many associations to Chester and Merseyside.

9.4.7 The study area overlaps NCA59 Wirral14. A summary of the relevant key characteristics of NCA59 is provided below:

a) A low-lying but gently rolling platform punctuated by low sandstone outcrops.

b) The large, funnel-shaped Dee Estuary lies between the Wirral peninsula and north-east Wales.

c) Drainage is into the Dee Estuary in the west with a network of small streams and drainage ditches.

d) Woodland is predominantly broadleaved with woodland cover on sandstone ridges, country parks and country estates.

e) The formal landscape has been created by former large country estates and the core of the area is mixed agricultural land with areas of improved pasture and arable farming.

f) Fields are defined by intermittent clipped hedgerows with copses, some red sandstone walls and marl pits; coastal areas often feature a geometric field pattern bounded by ditches draining former marshland.

g) The coast and estuary are recognised for their wildlife and habitats.

h) The rural landscape is interspersed with residential commuter-belt development, linked by an intricate network of lanes.

i) Red sandstone is common throughout the area; the pink hues bring warmth to the landscape and provide a unifying theme.

Marine character

9.4.8 Although the Scheme is not an offshore development, the potential impact on seascapes is considered. The study area overlaps the Dee Estuary Marine Character Area (MCA). Key characteristics relevant to the study area include the following:

a) The Dee Estuary forms a natural border between Wales and England, backed by the rising foothills of the Clwydian Range.

b) The Estuary is internationally and nationally designated for biodiversity, expansive intertidal mudflats and saltmarsh support thousands of wetland birds.

c) Flat, open topography and low water sand means the area can be quickly inundated during high tides.

d) Nationally important industries continue to dominate.

9.4.9 In England, MCA 36 Dee and Mersey Estuaries and Coastal Waters overlaps the Dee Estuary (Wales) MCA. A summary of the relevant key characteristics is provided below:

a) A high tidal range and shallow, very gently shelving coastal waters with sand banks and mudflats.

b) The funnel shape of the Dee Estuary encourages sedimentation which, over time, has caused ports in the upper reaches of the estuary to silt up.

c) Mudflats, sand flats, man-made lagoons and salt marshes are internationally important for a range of wildfowl and wading bird populations.

Landscape character areas

9.4.10 LCAs have been derived from LANDMAP data and the CWCC Landscape Character Assessment. The evaluation of LANDMAP aspect areas that overlap the search area are shown in Figures 9.3 to 9.8 and a summary of their assessment is presented in Appendix 9-A. CWCC LCAs that overlap the search area are included in Drawing 9.7 and a summary of their assessment is presented in Appendix 9-B.

9.4.11 LCAs in Flintshire have been derived from the five LANDMAP aspect areas and are at a similar or finer level of detail. The Visual and Sensory aspect area is used as a starting point and then refined with data from the other four aspect areas and field survey. LCAs in Cheshire have been derived from the CWCC assessment and refined.

9.4.12 Following guidelines set out in GN46, for LANDMAP Geological Landscape and Landscape Habitat aspects layers, areas considered are those which the Scheme overlaps and those that are adjacent to it. For LANDMAP Visual and Sensory, Historic Landscape, Cultural Landscape Services aspect layers, areas considered are those that the ZTV overlaps.

9.4.13 Landscape character areas (LCAs), each with consistent character, have been identified within the study area and are shown on Figure 9.9. A description of physical and perceptual characteristics and a judgement of landscape value and susceptibility to change are presented in Appendix 9-C. Table 9.7 to 9.10 summarise the assessment of the baseline. The character areas are divided into landscape, seascape, townscape and transport areas.

Table 9-7 Landscape Sensitivity – Landscape Character Areas

Ref	Name	Landscape value	Susceptibility to change	Landscape sensitivity
1	Aston, Aston Hall Agriculture	Medium	Low	Low
2	Deeside Industrial Park, Shotton Steelwork Lagoons	High	Low	Medium

Ref	Name	Landscape value	Susceptibility to change	Landscape sensitivity
3	Deeside Industrial Park, Shotwick Brook Lagoons	Low	Negligible	Negligible
4	Ewloe Sand Pits	Medium	Low	Low
5	Mancot, Pentre Agriculture	Medium	Low	Low
6	Queensferry, Dee Bank Agriculture	Low	Low	Low
7	River Dee Coastal Slopes, Broughton to Mancot	Medium	Low	Low
8	River Dee Flood Plain	Medium	Low	Low
9	River Dee Reclaimed Agriculture, Sandycroft	Medium	Negligible	Low
10	River Dee Reclaimed Agriculture, Sealand	Medium	Negligible	Low
11	River Dee Reclaimed Agriculture, Sealand Manor	Medium	Low	Low
12	Shotton Steelworks Recreation Area	Low	Negligible	Negligible
13	Wepre Brook Agriculture	Medium	Negligible	Low
14	Wepre Crossing Recreation Area	Low	Negligible	Negligible

9.4.14 Where the landscape sensitivity is judged as Negligible, the significance of effect would not be a material consideration in the decision-making process and the character areas are filtered out from further assessment. LCA03 Deeside Industrial

Park – Shotwick Lagoons, LCA12 Shotton Steelworks Recreation Area and LCA14 Wepre Crossing Recreation Area are excluded.

Table 9-8 Landscape Sensitivity – Seascape Character Areas

Ref	Name	Landscape value	Susceptibility to change	Landscape sensitivity
15	River Dee Estuary	High	High	High

Table 9-9 Landscape Sensitivity – Townscape Character Areas

Ref	Name	Landscape value	Susceptibility to change	Landscape sensitivity
16	Aston, Aston Hall Settlement	Medium	Negligible	Low
17	Aston Residential Area	Low	Negligible	Negligible
18	Connah's Quay High Street	Low	Negligible	Negligible
19	Connah's Quay, Wepre Residential Area	Low	Negligible	Negligible
20	Deeside Industrial Park, Parkway	Low	Negligible	Negligible
21	Deeside Industrial Park, Shotton Steelworks	Low	Negligible	Negligible
22	Deeside Industrial Park, Tenth Avenue	Low	Negligible	Negligible
23	Ewloe Green Settlement	Medium	Negligible	Low
29	Queensferry, Chester Road Industry and Pentre Trade Park	Low	Low	Low

Ref	Name	Landscape value	Susceptibility to change	Landscape sensitivity
30	Queensferry, Factory Road Industry	Low	Low	Low
31	Queensferry, Station Road Industry	Low	Low	Low
32	Queensferry Town Centre	Low	Low	Low
33	RAF Sealand	Low	Negligible	Negligible
34	River Dee Estuary, River Road	Low	Negligible	Negligible
35	Sandycroft, Willow Brook Residential Area	Low	Negligible	Negligible
36	Sandycroft Residential Area	Low	Negligible	Negligible
37	Sealand, Garden City Residential Area	Low	Medium	Low
38	Sealand, Northern Gateway Development Site	Medium	Low	Low
39	Sealand Manor Settlement	Medium	Medium	Medium
40	Shotton, Chester Road West and Chester Road East	Low	Negligible	Negligible
41	Shotton, East Residential Area	Low	Negligible	Negligible
42	Shotton, Higher Residential Area	Low	Low	Low
43	Shotton, West Residential Area	Medium	Negligible	Low

9.4.15 LCA17 Aston Residential Area, LCA18 Connah's Quay High Street, LCA19 Connah's Quay Wepre Residential Area, LCA20 Deeside Industrial Park Parkway, LCA21 Deeside Industrial Park Shotton Steelworks, LCA22 Deeside Industrial Park Tenth Avenue, LCA25 Mancot Residential Area, LCA33 RAF Sealand, LCA34 River Dee Estuary River Road, LCA35 Willow Brook Residential Area, LCA36 Sandycroft Residential Area, LCA40 Shotton Chester Road, and LCA41 Shotton East Residential Area are filtered out from further assessment.

Table 9-10 Landscape Sensitivity – Transport Character Areas

Ref	Name	Landscape value	Susceptibility to change	Landscape sensitivity
44	A494, Plough Lane Junction to Queensferry Junction	Low	Low	Low
45	A494, Queensferry Junction to Deeside Park Junction	Low	Low	Low
46	A494, Shotwick Interchange to M56 Junction 11	Low	Negligible	Negligible
47	A55/A494 Ewloe Interchange and St David's Junction	Low	Negligible	Negligible
48	Chester and Holyhead Railway, Saltney Ferry to Shotton	Low	Low	Low
49	Chester and Holyhead Railway, Shotton to Flint	Low	Negligible	Negligible
50	River Dee Canal, Saltney Ferry to Wepre Gutter	High	High	High

Ref	Name	Landscape value	Susceptibility to change	Landscape sensitivity
51	Wrexham-Bidston Railway – Hawarden to Shotton	Low	Negligible	Negligible
52	Wrexham-Bidston Railway – Shotton to Birkenhead Junction	Medium	Negligible	Low

9.4.16 LCA46 A494 Shotwick Interchange to M56, LCA47 A55/A494 Ewloe Interchange and St David's Junction, LCA49 Chester and Holyhead Railway Shotton to Flint and LCA51 Wrexham-Bidston Railway Hawarden to Shotton are filtered out from further assessment.

Visual receptors

Zone of theoretical visibility

9.4.17 The baseline visual amenity is outlined below, initially with a description of the ZTV, then by an examination of the type of visual receptors and the existing view of the A494 and River Dee Bridge. This has guided the design of the mitigation and the evaluation of the potential significance of visual effect.

9.4.18 The ZTV shows the visual extent of the replacement bridge and new road alignment to tie-in with the existing road, this is illustrated in Figure 9.1. It has been used to refine the search area and guide identification of potential visual receptors. The terrain model used as the basis of the ZTV has no surface features such as buildings or substantial vegetation that may potentially screen views of the A494. The bare earth surface model provides a 'worst-case scenario.

9.4.19 Target points have been set at intervals along the Scheme centreline and at set heights above the proposed landform. These include the following:

a) Road surface, bridge parapet and central barrier +1 m.

b) Cars +2 m.

c) High-sided vehicles +4 m.

d) Structures (lighting columns and sign gantry) +12 m.

9.4.20 The observer height has been set at 1.6 m which is based on an architectural standard average eye-level of people in the United Kingdom. The ZTV for the restored landform extends beyond the 3 km buffer search area from the replacement bridge centreline. It indicates that the Scheme would be visible from coastal valley sides, flat lowland reclaimed land urban and suburban settlements and areas of industry.

9.4.21 Settlements within the search area include Connah's Quay, Shotton, Queensferry, Aston, Ewloe, Hawarden, Mancot, Pentre, Sandycroft, Garden City and Sealand.

Potential visual receptors and visual baseline

9.4.22 Existing views of the potential visual receptors for the Scheme and a judgment of their visual sensitivity are presented in Appendix 9-D, which includes selected representative viewpoints and a baseline description. The locations of the viewpoints are shown in Figure 9.1. Near distance views are those that are within 0.5 km from the Scheme boundary. Intermediate distance views are those between 0.5 and 2 km from the Scheme boundary. Long-distance views are those more than 2 km away.

9.4.23 Figure 9.10 presents the locations of the main transport and recreational routes within the 2 km buffer study area. Landscape designations such as green spaces are presented in Figure 9.5.

9.4.24 Representative viewpoints and a description of the visual baseline are presented in Appendix 9-D. The locations of the viewpoints are shown in Figure 9.1. The representative views and their visual sensitivity are summarised in Table 9-11.

Table 9-11 Representative viewpoints

Ref	Location	Susceptibility to change	Value attached to view	Visual sensitivity
1	Lower Aston Hall Lane (LCA01)	Medium	Medium	Moderate

Ref	Location	Susceptibility to change	Value attached to view	Visual sensitivity
2	Hawarden Bridge (LCA52)	High	Medium	Moderate
3	Rowley's Drive (LCA06)	Medium	Low	Low
4	Dee View (LCA42)	High	Low	Moderate
5	Chevron's Road footbridge (LCA44)	Medium	Low	Low
6	Clay Hill Farm (LCA41)	Medium	Low	Low
7	Queensferry town centre (LCA32)	Low	Low	Low
8	Old Hall Farm (LCA08)	High	Medium	Moderate
9	Hawarden Cemetery (LCA07)	Medium	Medium	Moderate
10	Queensferry Junction (LCA44)	Medium	Low	Low
11	Greenacres Farm (LCA05)	Medium	Medium	Moderate
12	Queen Street (LCA32)	High	Low	Moderate
13	Dundas Street (LCA32)	High	Low	Moderate
14	Northern Gateway development site (LCA38)	Low	Medium	Low
15	LCA29 Pentre Trade Park	Low	Low	Low
16	Expressway Business Park, Station Road (LCA31)	Low	Low	Low
17	Pentre (LCA26)	Medium	Low	Low

Ref	Location	Susceptibility to change	Value attached to view	Visual sensitivity
18	Bascule Bridge (LCA50)	High	Low	Moderate
19	Welsh Road, Garden City (LCA37)	Low	Low	Low
20	Claremont Avenue / Wales Coast Path (LCA37)	High	Low	Moderate
21	Chemistry Lane / Factory Road (LCA28)	Medium	Low	Low
22	Wales Coast Path (LCA11)	High	Low	Moderate
23	Aston Quay landing stage (LCA50)	High	Medium	Moderate
24	Ferrybank Farm (LCA45)	Medium	Low	Low
25	Rector's lane footbridge (LCA48)	Low	Low	Low
26	Willans and Robinson landing stage (LCA50)	Medium	Medium	Moderate
27	Foxes Lane (LCA11)	Medium	Medium	Moderate
28	Sealand Embankment (LCA29)	Medium	Low	Low
29	Manor Road (LCA39)	Medium	Low	Low

9.5 Mitigation Measures Forming Part of the Scheme Design

Summary of requirements

9.5.1 The designers followed an iterative design and assessment process to meet the Scheme objectives. At all stages, the design was developed and refined to future-proof the Scheme against predictable circumstances and to support Welsh

Government objectives, including the need to encourage active travel and support the sustainability objectives of the Well-being of Future Generations (Wales) Act 2015. The design team sought to avoid and reduce the landscape and visual effects and to incorporate measures required by other environmental disciplines.

9.5.2 Mitigation and enhancement measures have been designed to implement key objectives found in the EU, UK and Welsh legislation, policy and best practice guidance documents on landscape assessment, design and mitigation. Close liaison with other disciplines to reduce habitat fragmentation and prioritise habitat connectivity and facilitation of species dispersal has been reflected in the mitigation measures.

Scheme environmental objectives

9.5.3 Environmental objectives were developed in parallel with the Transport Planning Objectives and agreed with the Statutory Environmental Consultees. These objectives are included within ES Chapter 1. Objectives for landscape design have been developed from these.

Landscape design objectives

9.5.4 The landscape proposals that form part of the Scheme are shown on the Environmental Master Plan (Figure 2.3). These take into consideration the landscape constraints as identified in the baseline desk study, survey and consultation.

9.5.5 The objectives that have guided the development of the landscape and environmental design, which include mitigation and enhancements, are listed below.

a) Respect the historic fabric of the landscape so that it will be retained for future generations.

b) Retain and make best use of existing vegetation, considering translocation of coppiced vegetation wherever a suitable donor site is available within the Scheme.

c) Avoid loss or damage to landscape features (e.g. hedgerows, individual and veteran trees, woodland and water features, public rights-of-way and field systems) where possible within the constraints of the design.

d) Consider the integration of new structures and measures for reducing the risk of pollution and associated impacts on local hydrology into the landscape setting of the Scheme.

e) Maintain and enhance connectivity of existing shared use foot and cycle path networks.

f) Optimise protection for nearby dwellings or public open spaces to minimise visual intrusion by providing screening, , planting and boundary treatments in critical locations.

g) Design the scheme of landscape mitigation to minimise the loss of foraging habitat for wildlife, avoiding increased habitat fragmentation and isolation and by maintaining connectivity across the landscape for protected species and other wildlife.

h) Integrate ecological mitigation with landscape measures and so add value as a refuge for local biodiversity.

i) Design for maintenance, giving due consideration to the maintenance costs and implications, liabilities and access arrangements for all landscape areas.

9.5.6 The environmental design principles for the Scheme reflect the environmental context and key requirements of the environmental drivers for integration. They include the following:

a) Provide appropriate landscape, visual, ecological and environmental mitigation whilst minimising land take and impact on the River Dee Site of Special Scientific Interest and the River Dee and Bala Lake Special Area for Conservation.

b) Retain as much existing mature vegetation as possible.

c) Establish new planting to screen, integrate and enhance the Scheme into the surrounding landscape whilst maintaining cohesion with retained landscape features.

d) Maintain the quality of views to and from surrounding receptors.

e) Use planting appropriate to the area to reflect the local character and to link the Scheme to existing features, providing physical habitat and wildlife corridors and visual continuity.

f) Use habitat creation to offset habitat loss and nature conservation value.

g) Use lighting with low spillage and consider carefully the design and siting of road signs, traffic signals, environmental barriers and street furniture.

h) Improve cycle and pedestrian approaches alongside the Scheme as well as the meeting points at junctions and crossings.

Biodiversity and Connectivity

9.5.7 Chapter 8 Ecology and Nature Conservation determines proposed biodiversity mitigation, much of which is integral to the landscape design. Land taken that is ancillary to the road surface, such as earthwork embankments and drainage channels or severed land parcels, can be used to contribute towards the biodiversity objectives. Chapter 14 Population and Human Health shows how public rights of way would be connected across the Scheme.

9.5.8 The following points have been considered in the design of landscape mitigation:

a) Native planting and seeding to provide species-rich areas should, where appropriate, be carried out using species and material of local provenance.

b) Compensation for the loss of saltmarsh would be provided at the location offsite, under discussion with FCC and NRW.

c) Hedgerows positioned to screen light generated by the Scheme and from surrounding built-up areas to provide dark corridor routes for commuting and foraging bats. These would link up with areas of established vegetation.

d) Bat roosting boxes required to mitigate loss of known roosts in existing buildings.

e) Maintain existing public rights of way crossing the Scheme at Queensferry and at the River Dee and connect these links along the route to encourage non-motorised use.

Planting design for future maintenance

9.5.9 Planting areas would be designed to address the required Environmental Function as set out in the Design Manual for Roads and Bridges (DMRB), LD117 Landscape Design. The core functions are required to state the purpose of the various features and what they are intended to achieve in environmental terms.

9.5.10 Table 9-12 displays the Environmental Function requirements. Where features have multiple functions, it will be necessary to decide on the primary and secondary code to prioritise design or maintenance of the feature.

Table 9-12 Environmental function requirements

Environmental function	Definition
EFA Visual screening	Planting size, spacing and species selected to provide a dense screen to an appropriate height, for as long a season as is practicable. The planting specification and maintenance standards selected to maximise growth and establishment to achieve screening as soon as possible (no later than Year 10 after opening to traffic).
EFB Landscape integration	Planting, seeding, ground modelling and structure finishes carried out so as to soften the appearance of earthworks, environmental barriers and engineering features of the road in views from the road and the surrounding landscape (by Year 10).
EFC Enhancing the built environment	Planted and seeded areas next to pedestrian areas in town centres and on important approaches to town maintained to create a neat and tidy appearance (by Year 10).
EFD Nature conservation and biodiversity	Habitats managed so as to conserve, and where possible enhance, their nature conservation value (immediately and continuing).
EFE Visual amenity	Shape form and colour of planting and structure finishes to provide interest for the road user using species or materials appropriate to the local landscape character (by Year 10).
EFF Heritage	Where trees, vegetation or physical features of local importance have to be removed for safety reasons they shall be replaced by similar features in an appropriate and safe location (immediately and continuing).
EFG Auditory amenity	Noise reducing surfaces, earthworks or barriers (immediately and continuing).

Environmental function	Definition
EFH Water quality	Water pollution control measures and surface water outfalls (immediately and continuing).

Scheme landscape mitigation proposals and enhancements

9.5.11 The physical works associated with the Scheme would start at the western tie-in close to the Chester - Holyhead Railway Bridge, and end at the eastern tie-in with the existing A494/A550 at Garden City. The Scheme is a 1.2 km long with about 0.9 km of on-line replacement providing two lanes of traffic in each direction.

9.5.12 A new river crossing would be upriver of the existing A494 River Dee Bridge. The portal beneath the Chester and Holyhead railway line will be retained to accommodate the two carriageways of traffic and a shared-use path. Once the realigned carriageway and replacement bridge is constructed, works can begin on removing the deck and crossheads of the existing River Dee Bridge.

9.5.13 A more detailed description is given in Chapter 2 of this ES. The Scheme passes through reclaimed marshland. Man-made embankments and transport routes divide the flat lowland into its mixed uses of residential, commercial, industrial / infrastructure development and undeveloped agricultural areas.

Queensferry Junction to Chester and Holyhead Railway

9.5.14 The eastbound carriageway runs next to late nineteenth and early twentieth century terraced houses of Queen Street and Dundas Street and late twentieth century sheltered accommodation at Belvedere Close. A false cutting planted with ornamental trees and shrubs screens the roundabout and viaduct associated with Queensferry Junction from the residential area. Where the false cutting ends, a brick wall separates the residential area from the existing trunk road. Views from first floor rooms overlook the brick wall. Pedestrian access points between the residential streets and the A494 have been closed off for reasons of safety and security with metal barriers.

9.5.15 Existing vegetation on the false cutting would be retained as would the brick wall. The gap in the wall to the rear of the former builder's yard that once allowed pedestrian access between Queen Street and the path next to the A494 would be closed up permanently with red brick to match the local character. Space between the houses and the trunk road is limited so there is insufficient room to provide a planted visual barrier for reasons of road safety.

9.5.16 The spur of Chester Road East that served the former council depot would be redeveloped into a path shared between cyclists and pedestrians connecting Chester Road East and Queensferry town centre to Sealand and Garden City. This would provide an alternative traffic free connection for National Cycle Network Route 5 (Reading-Holyhead), which currently is on road following the B5441 through Queensferry.

9.5.17 The Queensferry Drain is culverted beneath Chester Road East. Here the intention is to realign the drain in an open channel running in parallel to the A494 and proposed shared use path. Existing mid-twentieth century dwellings and the former depot would be demolished. The banks and surroundings to the open channel would be managed to encourage a species-rich grassland. To the south of the drain, between the top of the bank and the boundary fence to Pentre Trade Park, the land would be planted with native species hedgerows to provide a corridor link for wildlife between plantations and hedges at Queensferry Junction and the semi-natural woodland that has developed on the Chester and Holyhead railway embankment.

9.5.18 Planting on the embankment next to the westbound carriageway and diverging slip road to Queensferry Junction would be retained and reinforced with additional planting to provide separation between the trunk road and the shared-use path whilst maintaining an outward view for road users.

Chester and Holyhead Railway Bridge

9.5.19 The new road layout would tie into the existing road layout to the east of the Network Rail bridge. The two carriageways and the shared use path would be accommodated within the existing bridge portal and the Queensferry Drain

culverted beneath the shared use path within the existing culvert. Woodland that has established on the railway embankment next to the westbound carriageway would be managed to remove limbs that overhang the road or impede the use of the shared use path.

Chester and Holyhead Railway to River Dee

9.5.20 The eastbound carriageway runs next to late twentieth century retail and business sites that are accessible from the B5441 Station Road. The new road alignment would shift southward from the existing road alignment, which would move faster-moving traffic away from the existing business areas.

9.5.21 Existing vegetation would be retained where not disturbed by construction. The roadside verge would be managed as native species trees and shrubs, and grassland with bulbs to provide visual amenity to road users. The intention is to reinforce the vegetative backdrop to the office and retail areas when viewed from Station Road and screen security fences and other visual detractors when viewed from the A494.

9.5.22 To the rear of the car dealership the existing bridge abutment would be removed, and the embankment slope regraded to accommodate a change to Public Footpath West Saltney 7. The intention is to provide a shared use path that would connect the riverside businesses and caravan park to the B5441 that is wider than the existing footpath. With the removal of the structure and earthworks, the trees to the rear of the car dealership would be removed including landmark Lombardy poplars. Here there is an opportunity to enhance the road passengers' visual experience by opening up downriver views of the Bascule Bridge, with its industrial backdrop that includes Hawarden Bridge, Shotton Steelworks, Flintshire Bridge and Connah's Quay power station.

9.5.23 The southward shift would encroach into land where the Queensferry Drain runs in an open channel and would require the realignment of the drain. It would also involve the construction of a new pumping station, an electricity sub-station and the Welsh Water sewage treatment plant outfall pipe. The drain would be realigned to run in an area of unused land that lies in-between the sewage works and the existing

drain, and the new pumping station and ancillary structures positioned next to the toe of the replacement bridge approach embankment slope.

9.5.24 The banks and surroundings to the open channel would be managed to encourage a species-rich grassland. To the south of the drain, between the top of the bank and the boundary to the sewage treatment works, the land would be planted with native species hedgerows to provide a corridor link for wildlife between the semi-natural woodland that has developed on the Chester and Holyhead railway embankment and the riverside.

9.5.25 At the top of the bridge approach embankment an environmental barrier would be constructed to mitigate traffic noise effect on the residential caravan park. The existing amenity woodland plantation which is on the westbound embankment between the bridge and Riverside Way junction would be removed. Some replacement shrub planting on the south facing embankment is proposed, to soften the appearance of the environmental barrier.

9.5.26 The Riverside Way junction layout would be reconfigured to provide access to the new pumping station, riverside business areas and the caravan park. Public Footpath West Saltney 6 would also be widened to provide a shared-used path connecting Factory Road to Dee Bridge. This would restore the footpath that used to connect Chemistry Lane to the landing stages and riverside engineering works. Along Chemistry Lane and the eastern edge of the sewage treatment plant, the path would be aligned to avoid the roots of trees.

River Dee Bridge

9.5.27 The replacement bridge would be about 40 m upstream of the existing bridge (centre line to centre line). Bridge parapet barrier to the downriver side would be of modular design and consist of four or five horizontal rails sections supported by posts, which would provide a glimpse of the Bascule Bridge and Dee Canal beyond to road passengers. To the upriver side, there would be a metal parapet separating the westbound carriageway from a shared use path and a pedestrian parapet guardrail, which would enable transient views upriver towards Saltney and the Peckforton Hills to pedestrians.

9.5.28 Once the replacement bridge is open to traffic, the existing bridge would be dismantled, the deck, beams and abutments removed. The intention is to retain the bridge piers and piles so as to avoid disturbance of silt in the riverbed and remove the risk of hazardous in river works.

River Dee to Drome Corner

9.5.29 The replacement alignment would tie-in with the existing alignment some 300 m east of the riverbank. For that section the road would be shifted away from the dwellings in Claremont Avenue. The sign-gantry would be removed.

9.5.30 To the eastbound carriageway side there would be a wider swathe of roadside verge. The intention here is to reinforce the planting on the existing embankment that separates Carlines Avenue from the A494 and also to increase the area of open and species-rich grassland at the road edge.

9.5.31 To the westbound side there would be disturbance to the vegetation that has become established on the south facing embankment due to the southward shift in alignment. There would be a need to tie-in the shared use path with the existing non-vehicular paths that connect Sealand and the riverside. To do this a ramp would be built that would extend the earthwork footprint. A consequence of this would be to reduce the length of the surface water swale which flows eastward towards Foxes Lane and in order to maintain the storage capacity it would be reprofiled.

9.5.32 To the westbound side the intention is to replicate the existing situation where the embankment planting screens a view of the road and traffic, and to some extent the sign gantry, to Ferrybank Farm and Sealand Manor. Scattered trees would be located on the lower slope to protect the setting of Ferrybank Farm. The corridor also creates a diverse transition between frequently cultivated arable land and the main road.

Construction

9.5.33 During construction, existing features to be retained would be protected through implementation of the Construction Environment Management Plan (CEMP) as set out in Chapter 19.

Monitoring of Scheme Landscape Mitigation Proposals

9.5.34 A five-year aftercare period for landscape areas would be implemented to aid the establishment and growth of new tree and shrub planting, seeding and other landscape elements to ensure that these achieve the landscape design functions as set out in this ES chapter and the Environmental Masterplan (Figures 2.3 A-D).

9.5.35 The establishment and growth would be monitored to identify and carry out any management interventions as are required to ensure that landscape areas satisfy the intended function and performance requirements that are set out in DMRB LD117. Monitoring of planting areas would include frequent aftercare visits to determine whether sufficient growth is being achieved.

9.5.36 At the end of the aftercare period the Scheme would be handed over to the North and Mid Wales Trunk Road Agent (NMWTRA), who would be the maintaining authority for the Scheme thereafter. For the landscape elements, this maintenance would include formal reporting of the progress of the Scheme against stated design and performance aims and on landscape interventions where progress or species establishment has not been as anticipated.

9.6 Assessment of Construction Effects

9.6.1 This section considers the effects of the Scheme in the construction phase.

Landscape Effects During Construction

9.6.2 The assessment of the sensitivity of the landscape baseline to the Scheme is presented in Appendix 9-C.

9.6.3 In accordance with the significance matrix (Table 9-5), LCAs deemed to be of negligible landscape sensitivity would not be predicted to experience a significant

adverse or beneficial effect, even if the magnitude of impact were Major. The following LCAs have been filtered out from further assessment mainly due to their low importance and physical and perceptual separation from the Scheme:

a) LCA03 Deeside Industrial Park – Shotwick Lagoons.
b) LCA12 Shotton Steelworks Recreation Area.
c) LCA14 Wepre Crossing Recreation Area.
d) LCA17 Aston Residential Area.
e) LCA18 Connah's Quay High Street.
f) LCA19 Connah's Quay Wepre Residential Area.
g) LCA20 Deeside Industrial Park Parkway.
h) LCA21 Deeside Industrial Park Shotton Steelworks.
i) LCA22 Deeside Industrial Park Tenth Avenue.
j) LCA25 Mancot Residential Area.
k) LCA33 RAF Sealand.
l) LCA34 River Dee Estuary River Road.
m) LCA35 Willow Brook Residential Area.
n) LCA36 Sandycroft Residential Area.
o) LCA40 Shotton Chester Road.
p) LCA41 Shotton East Residential Area.
q) LCA46 A494 Shotwick Interchange to M56.
r) LCA47 A55/A494 Ewloe Interchange and St David's Junction.
s) LCA49 Chester and Holyhead Railway Shotton to Flint.
t) LCA51 Wrexham-Bidston Railway Hawarden to Shotton.

Landscape Character Areas

LCA01 – Aston, Aston Hall Agriculture
The sensitivity of this character area to the Scheme is Low. This is based on a gently undulating and open landscape deemed to be of moderate scenic quality. The A494 is next to this character area from Plough Lane Junction to Queensferry Junction. The area is locally designated as a Green Barrier. The Scheme would not directly affect this character area. A view of construction activity is theoretically available, works associated with the demolition of existing buildings at Chester Road East.
Impacts on physical characteristics
There would be no change to the landform or landcover of this character area.
Impacts on perceptual characteristics
The character area is influenced by noise from the A494, the A550 Gladstone Way and other neighbouring built-up areas. Construction activities would cause a negligible detrimental reduction to the level of tranquillity.
Impacts on historic and cultural characteristics
There would be no impact on historic or cultural features within the area.
Combining low landscape sensitivity and negligible magnitude of impact, the significance of effect on LCA01 is judged as Neutral.

LCA02 - Deeside Industrial Park, Shotton Steelwork Lagoons
The sensitivity of this character area to the Scheme is Medium. This is based on a flat open reclaimed saltmarsh landscape deemed to be of low scenic quality with statutorily protected waterbodies that once formed part of the Shotton Steelworks furnace site's water supply and management system. The Scheme would not directly affect this character area. A view of construction activity is theoretically available, works associated with the construction of the replacement bridge and the removal of the existing bridge, but a combination of industrial buildings, substantial vegetation on railway embankments and new development at the Northern Gateway site would interrupt the view.
Impacts on physical characteristics
There would be no change to the landform or landcover of this character area.

LCA02 - Deeside Industrial Park, Shotton Steelwork Lagoons
Impacts on perceptual characteristics
The area is at an intermediate to long distance from the Scheme. Shotton Steelworks industrial buildings, the Wrexham-Bidston railway line and development occurring at the Northern Gateway site intervene in the view of Dee Bridge. There would be no change.
Impacts on historic and cultural characteristics
There would be no impact on historic or cultural features within the area.
Combining medium landscape sensitivity and no change magnitude of impact, the significance of effect on LCA02 is judged as Neutral.

LCA04 - Ewloe Sand Pits
The sensitivity of this character area to the Scheme is Low. This is based on a gently undulating landform deemed to be of moderate scenic quality with a local Green Barrier designation at an intermediate to long distance from the Scheme. The Scheme would not directly affect this character area. A view of construction activity is theoretically available, works associated with the demolition of existing buildings at Chester Road East, but an accumulation of built-up areas and boundary vegetation between Ewloe and Queensferry would interrupt the view.
Impacts on physical characteristics
There would be no change to the landform or landcover of this character area.
Impacts on perceptual characteristics
The area is influenced by noise and movement from the A494 at Aston Hill, traffic travelling between Hawarden and Shotton along Aston Hall Lane and intermittent trains using the Wrexham-Bidston line.
Impacts on historic and cultural characteristics
There would be no impact on historic or cultural features within the area.
Combining low landscape sensitivity and no change magnitude of impact, the significance of effect on LCA04 is judged as Neutral.

LCA05 - Mancot, Pentre Agriculture
The sensitivity of this character area to the Scheme is Low. This is based on a flat lowland farmland reclaimed from saltmarsh deemed to be of moderate scenic quality with a local Green Barrier designation at near to intermediate distance. The Scheme would not directly affect this character area. A view of construction activity is theoretically available, works associated with the demolition of the former depot, dwellings and garages at Chester Road East. The former amenity site that is accessible from the B5129 and the site of the garages is being considered for temporary use as a construction site compound.
Impacts on physical characteristics
There would be no change to the landform or landcover of this character area.
Impacts on perceptual characteristics
The influence of part of the Scheme during construction would be perceptible from parts of the character area with uninterrupted views towards Dry Bridge Farm and where Chester Road East meets the embankment of the A494. There is substantial vegetation surrounding Queensferry Junction to mitigate views of the A494 and the former amenity site, and to provide privacy to Dry Bridge Farm. Negligible adverse.
Impacts on historic and cultural characteristics
There would be no impact on historic or cultural features within the area.
Combining low landscape sensitivity and negligible magnitude of impact, the significance of effect on LCA05 is judged as Neutral.

LCA06 – Queensferry, Dee Bank Agriculture
The sensitivity of this character area to the Scheme is Low. This is based on a flat lowland farmland reclaimed from saltmarsh and deemed to be of low scenic quality. Non-designated area at near to intermediate distance. The Scheme would not directly affect this character area. A view of construction activity is theoretically available, works associated with the removal of the existing bridge after construction of the replacement bridge, removal of the Garden City sign gantry and reconfiguration of lighting columns.

LCA06 – Queensferry, Dee Bank Agriculture
Impacts on physical characteristics
There would be no change to the landform or landcover of this character area.
Impacts on perceptual characteristics
The railway and river embankments interrupt activities at Queensferry and Northern Gateway. There is intermittent activity on the Chester and Holyhead line and frequent access through the area for pedestrians and cyclists accessing the River Dee paths. At the southern end there is influence from access and activity to businesses at Station Road. Vehicles using the A494 are not distinguishable. There is a group of Lombardy poplar trees at the eastbound approach to Dee Bridge, these tall columnar trees are a landmark species of the River Dee environs and are visible from a wide area. Works to regrade the embankment after the removal of the bridge abutment and improvement to footpath West Saltney 7 would likely cause irreparable harm to the root system requiring that these trees be removed. These trees may require removal on grounds of tree health due to their life expectancy regardless of proposed works.
Impacts on historic and cultural characteristics
There would be no impact on historic or cultural features within the area.
Combining low landscape sensitivity and negligible magnitude of impact, the significance of effect on LCA06 is judged as Neutral.

LCA07 - River Dee Coastal Slopes, Broughton to Mancot
The sensitivity of this character area to the Scheme is Low. This is based on a gently sloping valley side deemed to be of moderate scenic quality with a local Green Barrier designation at intermediate to long distance. The Scheme would not directly affect this character area. A view of construction activity would be available, including works associated with the construction of the new alignment and eventual removal of the existing carriageway between the Chester and Holyhead railway and River Dee, the removal of the Garden City sign gantry and reconfiguration of lighting columns.
Impacts on physical characteristics
There would be no change to the landform or landcover of this character area.

LCA07 - River Dee Coastal Slopes, Broughton to Mancot
Impacts on perceptual characteristics
Substantial vegetation next to the B5129, the Chester and Holyhead railway and Welsh Water sewage treatment works provide a barrier to views of the former council depot to be demolished and the existing Dee Bridge. Construction activity would be distinguishable where vegetation or large-scale industrial and retail buildings do not impede the view. The available view is one that includes built-up areas from Connah's Quay to Sandycroft including large-scale industry at Deeside Industrial Park and Factory Road. The Scheme would form only a very small and barely noticeable part of views and activity. Negligible detriment.
Impacts on historic and cultural characteristics
There would be no impact on historic or cultural features within the area.
Combining low landscape sensitivity and negligible magnitude of impact, the significance of effect on LCA07 is judged as Neutral.

LCA08 – River Dee Flood Plain
The sensitivity of this character area to the Scheme is Low. This is based on a flat lowland engineered landscape deemed to be of low scenic quality at a near to intermediate distance. The Scheme would not directly affect this character area. A view of construction activity is theoretically available, works to remove the existing bridge and Garden City sign gantry.
Impacts on physical characteristics
There would be no change to the landform or landcover of this character area.
Impacts on perceptual characteristics
Traffic using the existing bridge is noticeable, but the Bascule Bridge partially interrupts the view of the Dee Bridge. An accumulation of vegetation and buildings interrupt views of the eastbound and westbound approaches to the Dee Bridge. The removal of the Garden City sign gantry, the realignment of light columns to the Sealand side of the river and the removal of the existing bridge would be perceptible, but the overall balance of features would not change. Negligible adverse.

LCA08 – River Dee Flood Plain
Impacts on historic and cultural characteristics
There would be no impact on historic or cultural features within the area.
Combining low landscape sensitivity and negligible magnitude of impact, the significance of effect on LCA08 is judged as Neutral.

LCA09 – River Dee Reclaimed Agriculture - Sandycroft
The sensitivity of this character area to the Scheme is Low. This is based on a flat lowland agricultural landscape formed from reclaimed saltmarsh deemed to be of moderate scenic quality at an intermediate to long distance. The Scheme would not directly affect this character area. A view of construction activity would be interrupted by built-up areas including Mancot and Sandycroft residential areas, Chester Road and Pentre retail/industrial areas and the semi-natural woodland next to the Chester and Holyhead railway.
Impacts on physical characteristics
There would be no change to the landform or landcover of this character area.
Impacts on perceptual characteristics
There would be no visual or auditory influence on this character area.
Impacts on historic and cultural characteristics
There would be no impact on historic or cultural features within the area.
Combining low landscape sensitivity and no change magnitude of impact, the significance of effect on LCA09 is judged as Neutral.

LCA10 – River Dee Reclaimed Agriculture, Sealand
The sensitivity of this character area to the Scheme is Low. This is based on a flat lowland agricultural landscape formed on reclaimed saltmarsh between the natural course of the River Dee and Sealand Embankment. Deemed to be of moderate scenic quality it is at an intermediate to long distance. The Scheme would not directly affect this character area. A view of construction activity is theoretically available, works associated with the construction of the new bridge and tie-in with the Sealand side approach. Arable land near to Ferrybank Farm is being considered for temporary use as a construction site compound.
Impacts on physical characteristics
There would be no change to the landform or landcover of this character area.
Impacts on perceptual characteristics
The influence of the Scheme may be perceptible from parts of the character area with uninterrupted views towards Ferrybank Farm and the existing Dee Bridge. The area is flat with field boundary hedges and clusters of buildings that impede the perception of the proposed works. Negligible adverse to no change.
Impacts on historic and cultural characteristics
There would be no impact on historic or cultural features within the area.
Combining low landscape sensitivity and negligible/no change magnitude of impact, the significance of effect on LCA10 is judged as Neutral.

LCA11 – River Dee Reclaimed Agriculture, Sealand Manor
The sensitivity of this character area to the Scheme is medium. This is based on flat and open agricultural landscape of reclaimed saltmarsh deemed to be of moderate scenic quality. The A494 is next to this character area from Dee Bridge to Garden City Junction. The area is locally designated as Green Barrier. The Scheme would directly affect this character area, a portion of arable land next to the A494 is being considered for temporary use as a construction site compound. A site compound would contain offices, parking, materials and plant storage areas, and as an area for assembling structures prior to installation. The preferred part would be located between Foxes Lane/Ferrybank Farm and the River Dee embankment in the north-west of the character area.

LCA11 – River Dee Reclaimed Agriculture, Sealand Manor
Impacts on physical characteristics
There would be an increase in the amount of urban form within the area during construction as a result of site offices and welfare facilities, construction plant, machinery and materials. Temporary loss of about 3.3 ha of arable land where the land would be outside the proposed highway boundary and permanent loss of about 0.4 ha of arable land for the creation ecological enhancements to create connectivity between River Dee and Foxes Lane/Ferrybank Farm. Minor adverse.
Impacts on perceptual characteristics
A view of construction activity would readily be available from the north-western portion of this character area. Preparatory works associated with the removal of mature trees next to the existing Dee Bridge and the demolition of buildings at the Riverside Works would be visible. The construction and reconfiguration of the replacement embankment for westbound traffic and shared use path would require the import of material. Construction of the replacement bridge would be a key feature of construction activity. Once the replacement bridge has been constructed, a view of the works to remove the existing bridge would be partially interrupted by the new structure. The replacement bridge would be prominent in views from the north-western part of this character area as is the existing bridge. Minor adverse.
Impacts on historic and cultural characteristics
There would be a short-term minor adverse impact to the setting of Ferry Bank Farm listed building.
Combining low landscape sensitivity and minor adverse magnitude of impact, the significance of effect on LCA11 is judged as Slight adverse.

LCA13 – Wepre Brook Agriculture
The sensitivity of this character area to the Scheme is Low. This is based on a gently undulating coastal valley side deemed to be of moderate scenic quality with a local Green Barrier designation at intermediate to long distance. The Scheme would not directly affect this character area. A view of construction activities is theoretically available to River Dee facing slopes to the north-east of the B5125.
Impacts on physical characteristics
There would be no change to the landform or landcover of this character area.
Impacts on perceptual characteristics
A view of the River Dee coastline is available to parts of the gently rolling landform where is it not interrupted by field boundary vegetation. The view towards the A494 Dee Bridge is interrupted by substantial vegetation alongside Shotton Lane and the Wrexham-Bidston line. No change.
Impacts on historic and cultural characteristics
There would be no impact on historic or cultural features within the area.
Combining low landscape sensitivity and no change magnitude of impact, the significance of effect on LCA13 is judged as Neutral.

Seascape Character Areas

LCA15 – River Dee Estuary
The sensitivity of this character area to the Scheme is High. This is based on a flat estuarine and open landscape deemed to be of high scenic quality and internationally designated for nature conservation protection.
Impacts on physical characteristics
There would be no change to the landform or landcover of this character area. Works would be upriver of this location.

LCA15 – River Dee Estuary
Impacts on perceptual characteristics
Construction activities are theoretically visible from the estuary along the straight canalised section of the river. The view of the River Dee Bridge is interrupted by Hawarden Bridge and Bascule Bridge, a glimpse of the sign gantry may be available viewed through the lattice framework and piers of Hawarden Bridge. Any alteration would barely be perceptible and neither adverse nor beneficial. Negligible/No change.
Impacts on historic and cultural characteristics
There would be no impact on historic or cultural features within the area.
Combining high landscape sensitivity and no change magnitude of impact, the significance of effect on LCA15 is judged as Neutral.

Townscape Character Areas

LCA16 – Aston, Aston Hall Residential Area
The sensitivity of this character area to the Scheme is Low. This is based on a very gently sloping and enclosed suburban settlement deemed to be of low scenic quality. Edge of settlement designated as Green Barrier. The Scheme would not directly affect this area. A view of construction activity is theoretically available.
Impacts on physical characteristics
There would be no change to the landform or landcover of this character area.
Impacts on perceptual characteristics
The A494 is next to this character area at the bottom of Aston Hill, traffic noise and movement impacts on Lower Aston Hall Lane, Mountfield Road, Hillfield Road and Llys Gary Speed. The view towards the River Dee is interrupted by an accumulation of vegetation along the series of lanes severed by the A494, and planting at Queensferry Junction. A glimpse of the Garden City sign gantry may be available to the edges of the settlement during winter months. No change.
Impacts on historic and cultural characteristics
There would be no impact on historic or cultural features within the area.

LCA16 – Aston, Aston Hall Residential Area
Combining low landscape sensitivity and no change magnitude of impact, the significance of effect on LCA16 is judged as Neutral.

LCA23 – Ewloe Green Settlement
The sensitivity of this character area to the Scheme is Low. This is based on an undulating coastal valley side deemed to be of moderate scenic quality. Part of the settlement is locally designated as Green Barrier and is at a long distance. Theoretical view of construction activities available from the coast facing slopes of Old Aston Hill and fields near to Church Lane.
Impacts on physical characteristics
There would be no change to the landform or landcover of this character area.
Impacts on perceptual characteristics
Distant view of the Scheme interrupted by an accumulation of vegetation and built elements. No change.
Impacts on historic and cultural characteristics
There would be no impact on historic or cultural features within the area.
Combining low landscape sensitivity and no change magnitude of impact, the significance of effect on LCA23 is judged as Neutral.

LCA24 – Hawarden, Gladstone Way Residential Area
The sensitivity of this character area to the Scheme is Low. This is based on a landform at the transition of a gently sloping coastal valley side and flat reclaimed land deemed to be of low scenic quality and at an intermediate distance. Theoretical view of construction activities available.
Impacts on physical characteristics
There would be no change to the landform or landcover of this character area.

LCA24 – Hawarden, Gladstone Way Residential Area
Impacts on perceptual characteristics
Indirect view to residents living along Gladstone Way towards Queensferry Junction. The view of construction works would be interrupted by substantial vegetation in the plantations around Queensferry Junction. Indirect view to residents living along Overlea Drive towards Pentre Trade Park and Factory Road industrial area. Large-scale industrial/retail units are discernible, such as Makro wholesaler and the SPEN depot. The view of Dee Bridge is interrupted by an accumulation of vegetation alongside Chester Road, the Chester and Holyhead line and around the sewage treatment works. No change.
Impacts on historic and cultural characteristics
There would be no impact on historic or cultural features within the area.
Combining low landscape sensitivity and no change magnitude of impact, the significance of effect on LCA24 is judged as Neutral.

LCA26 – Mancot, Pentre Residential Area
The sensitivity of this character area to the Scheme is Low. This is based on a flat lowland settlement developed on reclaimed saltmarsh, an enclosed area deemed to be of low scenic quality at near to intermediate distance. The Scheme would not directly affect this character area. A view of construction activity is theoretically available, works associated with the demolition of existing buildings at Chester Road East.
Impacts on physical characteristics
There would be no change to the landform or landcover of this character area.

LCA26 – Mancot, Pentre Residential Area
Impacts on perceptual characteristics
The character area is influenced by traffic noise and movement from the B5129 that connects Queensferry to Broughton and the Pentre Trade Park, Chester Road industry and Factory Road industry. Views along Chester Road East are interrupted by the planting around Dry Bridge Farm and Pentre Trade Park. Views across fields are interrupted by a hedgerow next to the B5129. The former depot is visible in an indirect view to properties facing Chester Road, and its demolition would enable a view of the first floor Queen Street/Dundas Street terraced houses. Construction activities would be in combination with the constant activity experienced on Chester Road. Neither adverse nor beneficial.
Impacts on historic and cultural characteristics
There would be no impact on historic or cultural features within the area.
Combining low landscape sensitivity and no change magnitude of impact, the significance of effect on LCA26 is judged as Neutral.

LCA27 – Mancot, Willow Park Residential Area
The sensitivity of this character area to the Scheme is Low. This is based on a flat lowland settlement built on reclaimed saltmarsh. The A494 is next to this character area at Queensferry Junction, and the A550 Gladstone Way and B5129 Chester Road branch from the roundabout each passing one side. Part of the area is locally designated as Green Barrier. The Scheme would not directly affect this character area. A view of construction activities is theoretically available, works associated with the demolition of the former depot, dwellings and garages at Chester Road East. The former amenity site that is accessible from the B5129 and the site of the garages is being considered for temporary use as a construction site compound.
Impacts on physical characteristics
There would be no change to the landform or landcover of this character area.

LCA27 – Mancot, Willow Park Residential Area
Impacts on perceptual characteristics
The influence of part of the Scheme during construction would be perceptible from parts of the outer edges of the character area. There is substantial vegetation surrounding Queensferry Junction to mitigate views of the A494 and the former amenity site. Negligible adverse.
Impacts on historic and cultural characteristics
There would be no impact on historic or cultural features within the area.
Combining low landscape sensitivity and negligible magnitude of impact, the significance of effect on LCA27 is judged as Neutral.

LCA28 – Queensferry, Chemistry Lane Industry and Sewage Works
The sensitivity of this LCA to the Scheme is Low. This is based on a level and open landscape deemed to be of low scenic quality. The area has been developed in the past, fallen into disuse and then redeveloped. The existing A494 is next to this LCA from the Chester and Holyhead railway line to the River Dee. A row of Lombardy poplar and black poplar hybrid trees situated next to Chemistry Lane are protected by a TPO. There are several relics of the area's industrial heritage such as landing stages and jetties. The Scheme would directly affect this LCA. The realigned road leading to the replacement bridge would be constructed on land located in-between the existing A494 and the sewage works treatment and settlement tanks. Access to Riverside Way would be reconfigured to current design standards. Preparatory works would include the removal of roadside plantations and mature trees, and the demolition of buildings at the haulage depot at Riverside Works. The southward shift in alignment would displace Queensferry Drain in open channel and in culvert, pumping station, electricity sub-station, and sewage treatment outfall. The replacement channel and structures would require constructing before the demolition of the existing elements. Construction of a new approach embankment to carry the road to the replacement bridge would require the import of suitable material. The new alignment would tie in with the existing A494 east of the Chester and Holyhead line. Construction of the replacement bridge would be the key feature of construction activity.

LCA28 – Queensferry, Chemistry Lane Industry and Sewage Works
Impacts on physical characteristics
The construction of the new section of road would require earthworks movement to build up approaches to the River Dee crossing. A portion of the area would change from a mixture of developed land, disused land and land used as land drainage to construction work areas. There would be a loss of mature vegetation next to the existing A494 and there would be an increase in the amount of urban form through the presence of construction plant and machinery. Improvement to footpath West Saltney 6 to cater for shared use would require the removal of trees where it crosses into the land parcel formerly used as a scrap yard. The former scrap yard site is being considered for temporary use as a construction site compound. Moderate adverse.
Impacts on perceptual characteristics
Construction activities would create new conspicuous features within the landscape and the removal of mature vegetation would make the features appear more prominent. The character area is already influenced by noise from the existing A494 and neighbouring industrial areas, construction activities would cause a short-term reduction to levels of tranquillity. Moderate adverse.
Impacts on historic and cultural characteristics
There would be an erosion of historic features associated with Aston Quay, the Aston Hall Railway and the Queensferry Drain. Minor adverse.
Combining low landscape sensitivity and moderate adverse magnitude of impact, the significance of effect on LCA28 is judged as Slight adverse.

LCA29 – Queensferry, Chester Road Industry and Pentre Trade Park
The sensitivity of this character area to the Scheme is low. This is based on a level and enclosed townscape deemed to be of low scenic quality. The A494 is next to this character area from Queensferry Junction to the Chester and Holyhead line. Part of the area is within the Deeside Enterprise Zone. The Scheme would directly affect this area. The A494 road alignment would not change but the proposal includes for creating a shared use track connecting Chester Road East and Queensferry town centre to the River Dee and running the culverted Queensferry drain within an open channel on land formerly of mixed-use including business, residential and a former council depot. Preparatory works would include the demolition of the buildings and the removal of trees where the open channel would be excavated. The former amenity site that is accessible from the B5129 and the site of the garages is being considered for temporary use as a construction site compound.
Impacts on physical characteristics
A section of the Queensferry Drain that currently runs in a culvert under Chester Road East would be realigned into an open channel. A portion of the area would change from a mixture of developed land with gardens and disused land to construction work areas. There would be a loss of garden vegetation and there would be an increase in the amount of urban form through the presence of construction plant and machinery. Minor adverse.
Impacts on perceptual characteristics
Construction activities would create new conspicuous features. The character area is already influenced by noise from the A494 and neighbouring built-up areas, construction activities would cause a short-term reduction to levels of tranquillity. Minor adverse.
Impacts on historic and cultural characteristics
There would be no adverse effect on features of historic and cultural importance within the area.
Combining low landscape sensitivity and minor adverse magnitude of impact, the significance of effect on LCA29 is judged as Slight adverse.

LCA30 – Queensferry, Factory Road Industry
The sensitivity of this character area to the Scheme is low. This is based on a level and enclosed townscape, deemed to be of low scenic quality. The area is developed and is part of the Deeside Enterprise Zone. Buildings associated with the former Queensferry Wireworks are Grade II listed. The north-western boundary of the character area is defined by Chemistry Lane, the Public Footpaths West Saltney 3 and 6 run in parallel for a section of Chemistry Lane, footpath 3 continues onto the Aston landing stage and footpath 6 follows the eastern boundary of the sewage treatment works. Footpath 6 is currently blocked by the boundary to the parcel of land formerly used as a scrap yard. The scrap yard site is being considered for temporary use as a construction site compound.
Impacts on physical characteristics
The paths would be improved to provide for shared cyclist and pedestrian use to connect Factory Road to Riverside Way and the replacement bridge. The shared use path would be aligned to avoid the root zone of the row of poplar trees designated with a TPO. Construction activities would create new conspicuous features within a neighbouring character area. Negligible adverse.
Impacts on perceptual characteristics
A view of construction activities at Chemistry Lane would be available to the northern-most portion of the Factory Road industrial area. From the north-eastern boundary with the River Dee, views of construction of the replacement bridge would be available, although partially filtered by vegetation near to the Aston landing stage. The increase in the amount of urban form through the presence of construction plant and machinery would be noticeable but would not alter the overall balance of features and elements in this active industrial area. Minor adverse
Impacts on historic and cultural characteristics
The setting of the listed buildings would not be affected by the Scheme.
Combining low landscape sensitivity and minor adverse magnitude of impact, the significance of effect on LCA30 is judged as Slight adverse.

LCA31 – Queensferry, Station Road Industry
The sensitivity of this character area to the Scheme is Low. This is based on a level and enclosed townscape deemed to be of low scenic quality. The area is developed as a mixture of retail, office and training sites with a small cluster of dwellings next to the Bascule Bridge, which is a Grade II listed structure (also listed in the community of Sealand). The south-eastern boundary of the LCA is defined by the A494 highway boundary from the Chester and Holyhead line to the River Dee Bridge. Improvements to Public Footpath West Saltney 7, which connects Riverside Way to Station Road would encroach into the land used for car sales and maintenance.
Impacts on physical characteristics
Improvement to the narrow footpath West Saltney 7 would encroach into an area used as car parking and amenity grassland. A row of heavily pruned trees would also be affected, some of which are already dead as a consequence of pollarding. The change in urban form would not be a noticeable alteration. No change.
Impacts on perceptual characteristics
With the replacement bridge constructed and traffic using the new road alignment the removal of the existing bridge and abutments would proceed. Regrading of the embankment to accommodate the widened shared use path would require the removal of roadside plantations and landmark Lombardy poplar trees. A view of the demolition and earthwork activities would be readily available. Construction activities would not cause a significant change to levels of tranquillity. Minor adverse.
Impacts on historic and cultural characteristics
The setting of the Bascule Bridge would not be affected by construction and demolition activities. With the existing Dee bridge removed the Bascule Bridge would be clearly visible to a longer length of riverbank routes such as Wales Coast Path and Burton Marsh Greenway.
Combining low landscape sensitivity and minor adverse magnitude of impact, the significance of effect on LCA31 is judged as Neutral.

LCA32 – Queensferry Town Centre
The sensitivity of this character area to the Scheme is Low. This is based on a level and enclosed townscape of low scenic quality. The Queensferry War Memorial Institute building is Grade II listed, and a row of trees alongside Hurlbutt's Drive are protected by a TPO. Residential areas are concentrated at the south-eastern portion of the character area, the side closest to the existing A494 and proposed works. The south-eastern boundary of the LCA is defined by the existing A494 boundary from Chevrons Road footbridge through Queensferry Junction to the Chester and Holyhead railway line. The Scheme would not encroach into the character area, but construction works would be immediately adjacent to the boundary. As the area is built-up, a view of changes during construction would be limited to Queen Street and Dundas Street. The addition of a shared use path and the realignment of Queensferry Drain would be built on land in-between the A494 and the Pentre Trade Park. Preparatory works would include the demolition of buildings on Chester Road East and the removal of some garden trees.
Impacts on physical characteristics
The reduction in the amount of urban form within the adjoining area would not have an impact on Queensferry Town Centre. No change.
Impacts on perceptual characteristics
Demolition activities would remove conspicuous features in a neighbouring character area, making existing buildings within Pentre Retail Park more visible. Buildings and garden trees that would be removed are currently in a neglected state, and their removal could be perceived as a positive change. Their replacement in the view by larger and more modern buildings could be perceived as a negative change. The character area is already influenced by road traffic and movement from within and from neighbouring character areas. A view of construction works to the east of the railway may be visible through the portal of the railway bridge. Minor adverse during construction.
Impacts on historic and cultural characteristics
The setting of Queensferry War Memorial Institute would not be affected by the Scheme.

LCA32 – Queensferry Town Centre
Combining low landscape sensitivity and minor adverse magnitude of impact, the significance of effect on LCA32 is judged as Slight adverse.

LCA37 – Sealand, Garden City Residential Area
The sensitivity of this LCA to the Scheme is low. This is based on a flat lowland and enclosed townscape deemed to be of low scenic quality. The A494 corridor divides this LCA into one section that has developed along Welsh Road and another that has developed along the A548 Sealand Road. Part of the LCA, the development on Sealand Road, is locally designated as Green Barrier. The Bascule Bridge is a Grade II listed structure (also listed in the community of Queensferry). The Scheme would directly impact a small part of this character area, and a view of construction activities would be available from part of Claremont Avenue next to the River Dee where the roadside plantation does not interrupt views of the A494.
Impacts on physical characteristics
The connection from Claremont Avenue to the River Dee paths would be widened and surfaced to improve access for pedestrians and cyclists. Negligible beneficial.
Impacts on perceptual characteristics
There would be an increase in the amount of urban form within an adjacent area during construction. Preparatory works visible would include the removal of vegetation next to the Dee Bridge on the western bank. The view of the construction of the replacement bridge would be partially interrupted by the existing bridge. The view of works to remove the existing bridge and its abutments would be available to dwellings backing onto the river. The character area is already influenced by traffic noise and movement from within and from neighbouring areas. Construction activities would combine with existing traffic activity in adversely affecting levels of tranquillity. Minor adverse.
Impacts on historic and cultural characteristics
There would be no detrimental impact on the setting of Bascule Bridge.

LCA37 – Sealand, Garden City Residential Area
Combining low landscape sensitivity and minor adverse magnitude of impact, the significance of effect on LCA37 is judged as Slight adverse.

LCA38 – Sealand, Northern Gateway Development Site
The sensitivity of this LCA to the Scheme is Low. This is based on a flat lowland and open landscape deemed to be of moderate scenic quality. The A494 is next to this character area from the Drome Corner Junction to the Dragon Bridge, where the Chester Millennium Greenway crosses the A494. The area is a strategic development undergoing rapid change. Shotton Steelworks Garden is RHPG. The Steelworks office buildings are Grade II listed.
Impacts on physical characteristics
There would be no change to the landform or landcover of this character area due to the Scheme.
Impacts on perceptual characteristics
Construction activities would create a new feature that replaces an existing feature. Trees that are a landmark in southward views would be lost. Tranquillity would not be noticeably reduced during construction. Negligible adverse.
Impacts on historic and cultural characteristics
There would be no detrimental impact on designated sites associated with Shotton Steelworks due to the Scheme.
Combining low landscape sensitivity and negligible adverse magnitude of impact, the significance of effect on LCA38 is judged as Neutral.

LCA39 – Sealand Manor Settlement
The sensitivity of this character area to the Scheme is Medium. This is based on a level and open townscape deemed to be of moderate scenic quality. The area is locally designated as Green Barrier. The Scheme would not directly affect this character area. A view of construction activity would be available to dwellings and outdoor spaces facing Manor Road. Preparatory works associated with the removal of mature trees and buildings next to the existing Dee Bridge would be visible. Construction of the replacement bridge would be a key feature of construction. Once the replacement bridge has been constructed, a view of the works to remove the existing bridge would be partially interrupted by the new structure. An area of arable land is being considered for use as a construction site compound, this area would be visible and partially interrupt the view of activities at the river.
Impacts on physical characteristics
There would be no change to the landform or landcover of this character area. There would be an increase in the amount of urban form within an adjacent character area during construction as a consequence of buildings, plant and machinery and materials storage associated with construction.
Impacts on perceptual characteristics
Construction activities would create a new conspicuous feature, visible from properties facing Manor Road and replacing the existing. The character area is already influenced by traffic noise and movement from the A494, construction activities would cause a short-term reduction to levels of tranquillity. Minor adverse.
Impacts on historic and cultural characteristics
There would be no impact on historic or cultural features within the area.
Combining medium landscape sensitivity and minor adverse magnitude of impact, the significance of effect on LCA39 is judged as Slight adverse.

LCA42 – Shotton, Higher Residential Area
The sensitivity of this character area to the Scheme is Low. This is based on a gently sloping and built-up coastal valley side deemed to be of low scenic quality and at an intermediate distance from the Scheme. The Scheme would not directly affect this character area. The ZTV predicts that there would be a view of construction activities associated with the removal of buildings at Chester Road East and the construction of the replacement bridge from parts of the residential area with an open eastward aspect.
Impacts on physical characteristics
There would be no change to the landform or landcover of this character area.
Impacts on perceptual characteristics
Views of construction activities would be interrupted by buildings in Queensferry town centre and throughout the residential area. The A494 forms this character area's south-eastern boundary. There is no effective mitigation for traffic noise and movement, particularly to residents of Aston Road.
Impacts on historic and cultural characteristics
There would be no impact on historic or cultural features within the area.
Combining low landscape sensitivity and no change magnitude of impact, the significance of effect on LCA42 is judged as Neutral.

LCA43 – Shotton, West Residential Area
The sensitivity of this character area to the Scheme is Low. This is based on a gently sloping and built-up coastal valley side deemed to be of low scenic quality and at an intermediate distance from the Scheme. The Scheme would not directly affect this character area. The ZTV predicts that there would be a view of construction activities associated with the removal of buildings at Chester Road East and the construction of the replacement bridge from parts of the residential area with an open south-eastward aspect.
Impacts on physical characteristics
There would be no change to the landform or landcover of this character area.

LCA43 – Shotton, West Residential Area
Impacts on perceptual characteristics
Views of construction activities would be interrupted by the Wrexham-Bidston line, buildings in Shotton and Queensferry town centre and throughout the residential area.
Impacts on historic and cultural characteristics
There would be no impact on historic or cultural features within the area.
Combining low landscape sensitivity and no change magnitude of impact, the significance of effect on LCA43 is judged as Neutral.

Transport Character Areas

LCA44 – A494, Plough Lane Junction to Queensferry Junction
The sensitivity of this character area to the Scheme is Low. This is based on a gently sloping to flat lowland and enclosed road corridor deemed to be of low scenic quality at near to intermediate distance. The Scheme would directly affect the LCA. To the north-east of Queensferry Junction, construction activities would involve the reconfiguration of the road layout beneath the Chester and Holyhead railway line to accommodate a shared use path. The removal of buildings at Chester Road East would open up the area.
Impacts on physical characteristics
There would be negligible beneficial change to the landform or landcover of this character area.
Impacts on perceptual characteristics
Construction activities would create a new corridor for the shared use path and Queensferry Drain once buildings have been removed. This character area is the major source of traffic noise and movement that affects neighbouring areas. Construction activities would not influence the tranquillity.
Impacts on historic and cultural characteristics
There would be no adverse effect on features of historic and cultural importance within the area.

LCA44 – A494, Plough Lane Junction to Queensferry Junction
Combining low landscape sensitivity and negligible benefit magnitude of impact, the significance of effect on LCA44 is judged as Neutral.

LCA45 – A494, Queensferry Junction to Deeside Park Junction
The sensitivity of this character area to the Scheme is Low. This is based on a level and open transport corridor deemed to be of low scenic quality. The Scheme would directly affect this character area. From the railway crossing to the point where the A494 crosses Foxes Lane, construction would reconfigure the road layout. West of the River Dee, the space used by the existing carriageway would be landscaped to bulk up areas of roadside planting, reformed to provide surface water attenuation and open grassland areas creating a wider and less confined road corridor. East of the river, the road layout would be reconfigured on land within the highway boundary. On the western side of the river, preparatory works would include the removal of roadside plantations, near to the River Dee Bridge. Direct access to Riverside Way from the westbound carriageway would be reconfigured. The area of arable land to the opposite side of Claremont Avenue is being considered for temporary use as a construction site compound, which would feature in views towards Sealand.
Impacts on physical characteristics
The construction of the new section of road on land next to the existing road would require earthworks movement to build up approaches to the River Dee crossing. There would be a loss of mature vegetation next to the existing A494 and there would be an increase in the amount of urban form through the presence of construction plant and machinery.
Impacts on perceptual characteristics
The removal of established roadside vegetation would open up views from the road of the River Dee up and down river. Construction activities would create a new conspicuous feature in the landscape. This character area is a source of much traffic noise and movement that affects neighbouring areas. Construction activities would not influence the lack of tranquillity.

LCA45 – A494, Queensferry Junction to Deeside Park Junction
Impacts on historic and cultural characteristics
The view of Bascule Bridge from the A494 would be opened up and be set further away. There would be no further detrimental effect on features of historic and cultural importance within the character area.
The transport character type would increase in area at the expense of a neighbouring arable landscape character type and a mixed use area of water treatment infrastructure, light industry and residential park. Combining low landscape sensitivity and minor adverse magnitude of impact, the significance of effect on LCA45 is judged as Neutral to Slight adverse.

LCA48 – Chester and Holyhead Railway, Saltney Ferry to Shotton
The sensitivity of this LCA to the Scheme is low. This is based on a level and enclosed transport corridor deemed to be of low scenic quality. The road layout within the railway bridge portal would be amended to incorporate a shared use path next to the westbound carriageway. Other than this, the Scheme would not directly affect this character area.
Impacts on physical characteristics
There would be no change to the landform or landcover of this character area.
Impacts on perceptual characteristics
This character area is a source of intermittent noise and movement and is already influenced by constant traffic noise and movement from the A494. Construction activities would not influence the lack of tranquillity.
Impacts on historic and cultural characteristics
There would be no impact on historic or cultural features within the area.
Combining low landscape sensitivity and no change magnitude of impact, the significance of effect on LCA48 is judged as Neutral.

LCA50 – River Dee Canal, Saltney Ferry to Wepre Gutter
The sensitivity of this character area to the Scheme is high. This is based on a lowland level and open landscape deemed to be of low scenic quality. The River Dee is statutorily protected for nature conservation. Bascule Bridge and Hawarden Bridge are Grade II listed buildings, in addition there are several jetties, landing stages, quays and pill boxes of historic interest. The earthwork embankments are used as non-traffic routes that connect to National Cycle Network, Wales Coast Path and other promoted routes. The Scheme would directly affect this LCA. The replacement river crossing is a key feature of the Scheme. The approach embankments on the western side of the river would affect the remains of Aston Quay and the existing outfall to the Queensferry Drain. New bridge piers and piles would replicate the existing bridge piers and piles and would be in direct contact with the tidal river and its bed.
Impacts on physical characteristics
An area of saltmarsh, mud and open water would change to construction work areas. The construction of the replacement bridge would involve disturbance to the riverbed, which is already routinely disturbed by tides. The new structure would place existing areas of salt marsh and mud in permanent shade even if they are not directly affected by works. Public Rights-of-Way on both sides of the river would also be crossed by the replacement bridge. Temporary closures and diversions may be required during construction. Minor adverse.
Impacts on perceptual characteristics
The replacement bridge would be a conspicuous and key feature of the Scheme. Removal of vegetation plus construction of earthwork embankments approaching the crossing and site compound area would be noticeable features within neighbouring character areas. The character area is already influenced by noise from the A494 and neighbouring industrial areas, construction activities would cause a short-term reduction to levels of tranquillity. Minor adverse.
Impacts on historic and cultural characteristics
There would be an erosion of historic remains associated with Aston Quay.
Combining high landscape sensitivity and minor adverse magnitude of impact, the significance of effect on LCA50 is judged as Moderate adverse.

LCA52 – Wrexham-Bidston Railway, Shotton to Birkenhead Junction
The sensitivity of this LCA to the Scheme is low. This is based on a level and enclosed transport corridor deemed to be of low scenic quality. The Scheme would not directly affect this character area. A view of construction activity is theoretically available from the railway on embankment and Hawarden Bridge.
Impacts on physical characteristics
There would be no change to the landform or landcover of this character area.
Impacts on perceptual characteristics
This character area is a source of intermittent noise and movement. Construction activities would not influence the lack of tranquillity. A glimpse of the upriver Dee Canal and Bascule Bridge is available when crossing Hawarden Bridge.
Impacts on historic and cultural characteristics
There would be no impact on historic or cultural features within the area.
Combining low landscape sensitivity and no change magnitude of impact, the significance of effect on LCA52 is judged as Neutral.

Summary of landscape effects during construction

9.6.4 Only the LCA52 River Dee Canal is predicted to experience a significant adverse effect during construction. Table 9-13 presents a summary of the assessment during construction.

Table 9-13 Landscape effects during construction

Ref	Location	Landscape sensitivity	Magnitude of impact	Significance of effect
1	Aston, Aston Hall Agriculture	Low	Negligible adverse	Neutral
2	Deeside Industrial Park, Shotton Steelwork Lagoons	Medium	No change	Neutral

Ref	Location	Landscape sensitivity	Magnitude of impact	Significance of effect
4	Ewloe Sand Pits	Low	Negligible adverse	Neutral
5	Mancot, Pentre Agriculture	Low	Negligible adverse	Neutral
6	Queensferry, Dee Bank Agriculture	Low	Negligible adverse	Neutral
7	River Dee Coastal Slopes, Broughton to Mancot	Low	Negligible adverse	Neutral
8	River Dee Flood Plain	Low	Negligible adverse	Neutral
9	River Dee Reclaimed Agriculture - Sandycroft	Low	No change	Neutral
10	River Dee Reclaimed Agriculture, Sealand	Low	Negligible adverse	Neutral
11	River Dee Reclaimed Agriculture, Sealand Manor	Low	Minor adverse	Slight adverse
13	Wepre Brook Agriculture	Low	No change	Neutral
15	River Dee Estuary	High	No change	Neutral
16	Aston, Aston Hall Residential Area	Low	No change	Neutral
23	Ewloe Green Settlement	Low	No change	Neutral
24	Hawarden, Gladstone Way Residential Area	Low	No change	Neutral
26	Mancot, Pentre Residential Area	Low	No change	Neutral
27	Mancot, Willow Park Residential Area	Low	Negligible adverse	Neutral
28	Queensferry, Chemistry Lane Industry and Sewage Works	Low	Moderate adverse	Slight adverse

Ref	Location	Landscape sensitivity	Magnitude of impact	Significance of effect
29	Queensferry, Chester Road Industry and Pentre Trade Park	Low	Minor adverse	Slight adverse
30	Queensferry, Factory Road Industry	Low	Minor adverse	Slight adverse
31	Queensferry, Station Road Industry	Low	Minor adverse	Slight adverse
32	Queensferry Town Centre	Low	Minor adverse	Slight adverse
37	Sealand, Garden City Residential Area	Low	Minor adverse	Slight adverse
38	Sealand, Northern Gateway Development Site	Low	Negligible adverse	Neutral
39	Sealand Manor Settlement	Medium	Minor adverse	Slight adverse
42	Shotton, Higher Residential Area	Low	No change	Neutral
43	Shotton, West Residential Area	Low	No change	Neutral
44	A494, Plough Lane Junction to Queensferry Junction	Low	Negligible benefit	Neutral
45	A494, Queensferry Junction to Deeside Park Junction	Low	Minor adverse	Slight adverse
48	Chester and Holyhead Railway, Saltney Ferry to Shotton	Low	No change	Neutral
50	River Dee Canal, Saltney Ferry to Wepre Gutter	High	Minor adverse	Moderate adverse
52	Wrexham-Bidston Railway, Shotton to Birkenhead Junction	Low	No change	Neutral

9.6.5 LCAs judged to experience a neutral significance of effect during construction would not be predicted to experience a significant adverse or beneficial effect, even if the magnitude of impact were Major during operation. The construction phase sees the largest magnitude of changes to landform and visual influence. The following LCAs have been filtered out from the assessment of operational effects due to their physical and perceptual separation from the Scheme.

a) LCA01 Aston, Aston Hall Agriculture.
b) LCA02 Deeside Industrial Park, Shotton Steelwork Lagoons.
c) LCA04 Ewloe Sand Pits.
d) LCA05 Mancot, Pentre Agriculture
e) LCA06 Queensferry, Dee Bank Agriculture.
f) LCA07 River Dee Coastal Slopes, Broughton to Mancot.
g) LCA08 River Dee Flood Plain.
h) LCA09 River Dee Reclaimed Agriculture, Sandycroft.
i) LCA10 River Dee Reclaimed Agriculture, Sealand.
j) LCA13 Wepre Brook Agriculture.
k) LCA15 River Dee Estuary.
l) LCA16 Aston, Aston Hall Residential Area.
m) LCA23 Ewloe Green Settlement.
n) LCA24 Hawarden, Gladstone Way Residential Area.
o) LCA26 Mancot, Pentre Residential Area.
p) LCA27 Mancot, Willow Park Residential Area.
q) LCA38 Sealand, Northern Gateway Development Site.
r) LCA42 Shotton, Higher Residential Area.
s) LCA43 Shotton, West Residential Area.
t) LCA44 A494, Plough Lane Junction to Queensferry Junction.
u) LCA48 Chester and Holyhead Railway, Saltney Ferry to Shotton.
v) LCA52 Wrexham-Bidston Railway, Shotton to Birkenhead Junction.

Visual Effects During Construction

9.6.6 The potential effects during construction on views from each of the representative viewpoints have been assessed. The assessment of the sensitivity of the visual baseline to the Scheme is presented in Appendix 9-D.

Representative viewpoints

1 – Lower Aston Hall Lane
From a Public Footpath (Hawarden 34), connecting Lower Aston Hall Lane to Overlea Drive. It represents the view from gently undulating farmland with scattered rural settlement. A clipped hedge limits views north-eastward from the footpath. The photograph was taken from a gap in the hedge at a field gate. Lower Aston Hall Lane connects Aston to Hawarden. The sensitivity of the visual receptor is Low.
Change in view during construction
The Garden City sign gantry would be removed from view.
Magnitude of visual change
The sign gantry is noticeable if looked for, it occupies a very small part of the view. Size and scale of change is negligible (a very minor noticeable improvement by the removal of an existing feature), duration is short term (less than 5 years), and distance is intermediate (0.5 to 2 km). Magnitude of change is judged as Negligible beneficial.
Significance of visual effect
Combining low visual sensitivity and negligible beneficial magnitude of visual impact, the significance of effect on representative viewpoint 1 is judged as Neutral.

2 – Hawarden Bridge
From National Cycle Network route 5 and Public Footpath West Saltney 12. Represents static views from flat lowland engineered landscape and transient views from users of regional designated routes. Photograph taken from ramp to Hawarden Bridge crossing. The sensitivity of the visual receptor is Moderate.

2 – Hawarden Bridge
Change in view during construction
The Garden City sign gantry would be removed from view, as would the trees at the western bridge embankment (seen behind Dee Villas). The construction of the replacement bridge would be partially interrupted by that of the existing bridge and Bascule Bridge. There would be a view of the plant used in the construction of the replacement bridge piles, bridge piers cap and bridge beams and eastern abutment. Once the replacement bridge is open to traffic, the plant used to remove the existing bridge deck and beams would be visible.
Magnitude of visual change
A494 road elements form a minor part of the upriver view of an engineered landscape of transport and power distribution infrastructure. Size and scale of change is minor (slight loss of existing elements and replacement), duration is short term (less than 5 years), and distance is intermediate (0.5 to 2 km). Magnitude of change is judged as Minor adverse.
Significance of visual effect
Combining moderate visual sensitivity and minor adverse magnitude of visual impact, the significance of effect on representative viewpoint 2 is judged as Slight adverse.

3 – Rowley's Drive
From Rowley's drive near to Dee Bank Cottages. The view is representative of one experienced by users of minor roads and countryside workers from flat open lowland farmland. The view is open and uninterrupted. The sensitivity of the visual receptor is Low.
Change in view during construction
The Garden City sign gantry would be removed from view. Lombardy poplar trees at the western approach to the bridge would be removed to accommodate the reprofiling of the embankment and improvement to Public Footpath West Saltney 7, after the removal of the bridge abutment. Plant used in the construction of the replacement bridge piers, beams and deck may be partially visible.

3 – Rowley's Drive
Magnitude of visual change
A494 road elements form a minor part of the view, and visible if looked for. Size and scale of change is minor (slight loss of existing elements and construction activity), duration is short term (less than 5 years), and distance is intermediate (0.5 to 2 km). Magnitude of change is judged as Minor adverse.
Significance of visual effect
Combining low visual sensitivity and minor adverse magnitude of visual impact, the significance of effect on representative viewpoint 3 is judged as Neutral.

4 – Dee View
From an informal path in front of the dwelling 6 Dee View. It represents the view available to the dense residential area at the eastern edge of Higher Shotton. A clipped hedge limits views from ground floor rooms but view from the first floor overlook this hedge. The sensitivity of the visual receptor is Moderate.
Change in view during construction
The view of construction activities would be interrupted by the retail superstore and the plantations surrounding Queensferry Junction.
Magnitude of visual change
There would be no change in view.
Significance of visual effect
Combining moderate visual sensitivity and no change magnitude of visual impact, the significance of effect on representative viewpoint 4 is judged as Neutral.

5 – Chevron's Road footbridge
From Chevron's Road footbridge above the road verge between the A494 and Aston Road. The view is open and uninterrupted by the bridge parapet. The transient view is representative of one available to users of public footpaths and is indirect to the direction of travel across the footbridge. The sensitivity of the visual receptor is Moderate.

5 – Chevron's Road footbridge
Change in view during construction
The view of construction activities would be interrupted by Queensferry town centre, the plantations surrounding Queensferry Junction and large-scale retail units at Pentre Trade Park. The location considered for use as a construction site compound next to Chester Road is screened from view by Queensferry viaduct and roadside plantations.
Magnitude of visual change
There would be no change in view.
Significance of visual effect
Combining moderate visual sensitivity and no change magnitude of visual impact, the significance of effect on representative viewpoint 5 is judged as Neutral.

6 – Clay Hill Farm
From Clay Lane at the junction with Public Footpath Hawarden 28 which follows the line of a long disused tramway/railway line that connected Aston Quay and Aston Hall Colliery railway to Mount Pleasant Brickworks in Buckley. The view is representative of a transient view available to users of Public Rights of Way and outdoor workers. The sensitivity of the visual receptor is Low.
Change in view during construction
The view of construction activities would be interrupted the plantations surrounding Queensferry Junction and field boundary hedgerows. The location considered for use as a construction site compound next to Chester Road is screened from view by substantial vegetation.
Magnitude of visual change
There would be no change in view.
Significance of visual effect
Combining low visual sensitivity and no change magnitude of visual impact, the significance of effect on representative viewpoint 6 is judged as Neutral.

7 – Queensferry town centre
From the roadside verge outside of the Grade II listed Queensferry War Memorial Institute. Representing the view available to pedestrians in Queensferry town centre and visitors to the community building. Views are limited by buildings alongside Chester Road West, Chester Road East, Mold Road and Station Road.
Change in view during construction
The view of construction activities would be interrupted the buildings along Station Road and Chester Road East, and the plantations surrounding Queensferry Junction. The location considered for use as a construction site compound next to Chester Road is screened from view by retail buildings, substantial vegetation and Queensferry viaduct.
Magnitude of visual change
There would be no change in view.
Significance of visual effect
Combining low visual sensitivity and no change magnitude of visual impact, the significance of effect on representative viewpoint 7 is judged as Neutral.

8 – Old Hall Farm
From Public Footpath West Saltney 8, near to The Lodge and Old Hall Farm. The view is representative of one experienced by users of public footpaths and countryside workers from a flat and open lowland landscape. Wales Coast Path runs in parallel to the footpath 8 sharing an alignment with Public Footpath West Saltney 16 along the riverbank. The sensitivity of the visual receptor is Moderate.

8 – Old Hall Farm
Change in view during construction
The Garden City sign gantry would be removed from view. The trees at the western bridge embankment are less noticeable as the viewer approaches Dee Villas and Station Road, trees in the middle ground also obscure them. The construction of the replacement bridge would be partially interrupted by that of the existing bridge and Bascule Bridge. There would be a view of the plant used in the construction of the replacement bridge piles, bridge pier cap and bridge beams and eastern abutment. Once the replacement bridge is open to traffic, the plant used to remove the existing bridge and supporting elements would be visible.
Magnitude of visual change
A494 road elements form a minor part of the upriver view of an engineered landscape of transport and power distribution infrastructure. Size and scale of change is minor (slight loss of existing elements and replacement), duration is short term (less than 5 years), and distance is intermediate (0.5 to 2 km). Magnitude of change is judged as Minor adverse.
Significance of visual effect
Combining moderate visual sensitivity and minor adverse magnitude of visual impact, the significance of effect on representative viewpoint 2 is judged as Slight adverse.

9 – Hawarden Cemetery
From part of cemetery south-east of Ash Lane. The view is one from gently sloping valley side and representative of one available to visitors to the cemetery and outdoor workers. The sensitivity of the visual receptor is Moderate.

9 – Hawarden Cemetery
Change in view during construction
Garden city sign gantry, River Dee bridge and plantations at the western approach to the bridge are visible, but not easily distinguishable. They would be removed from view. Construction plant machinery would not be easily visible. The location of the replacement bridge is screened from view by semi natural woodland alongside the Chester and Holyhead line and around the Welsh Water sewage treatment works.
Magnitude of visual change
Very minor noticeable change with the removal from view of parts of road infrastructure. Size and scale of change is negligible, duration is short term (less than 5 years), and distance is intermediate (0.5 to 2 km). Magnitude of change is judged as Negligible.
Significance of visual effect
Combining moderate visual sensitivity and negligible beneficial magnitude of visual impact, the significance of effect on representative viewpoint 9 is judged as Neutral.

10 – Plantation near to Pembroke Close
From a footpath linking the series of streets branching from Dyfed Drive and Chester Road East to Queensferry town centre. It represents a static view available to a less densely populated area and a transient view for users of public open space of limited importance. The sensitivity of the visual receptor is Low.
Change in view during construction
Bat roost boxes would be mounted onto mature trees to the left-hand side of the footpath. No other work is proposed within the plantation. The former depot building, Bridge Houses and Queensferry Autos garage would be demolished. The site of Queensferry Autos garage and former amenity site adjacent to it is being considered for temporary use as a construction site compound. This area would see much construction activity with the excavation of the realigned Queensferry Drain in an open channel once the buildings have been demolished.

10 – Plantation near to Pembroke Close
Magnitude of visual change
A part of the Scheme would cause change that is readily apparent to the viewer. The proposed works to the west of Chester and Holyhead line are not key features of the Scheme but enhancements to the local non traffic network and surface water management system. Size and scale of change is moderate, duration is short term (less than 5 years), distance is near (less than 0.5 km). Magnitude of change is judged as Moderate adverse.
Significance of visual effect
Combining low visual sensitivity and moderate adverse magnitude of visual impact, the significance of effect on representative viewpoint 10 is judged as Slight adverse.

11 – Greenacres Farm
From Greenacres Farm Park at the junction between Colliery Lane and Public Footpath Hawarden 32. View is representative of a transient view available to users of Public Rights of Way of limited importance, outdoor workers and visitors to tourist attractions. The sensitivity of the visual receptor is Moderate.
Change in view during construction
The view of construction activities would be interrupted by an accumulation of field boundary vegetation, buildings in Pentre and Pentre Trade Park, substantial vegetation and semi-natural woodland along the Chester and Holyhead line and around Pentre Trade Park.
Magnitude of visual change
There would be no discernible change in view.
Significance of visual effect
Combining moderate visual sensitivity and no change magnitude of visual impact, the significance of effect on representative viewpoint 11 is judged as Neutral.

12 – Queen Street
From the pavement outside of 21 Queen Street. It represents the view available to dense residential areas facing the A494. Unused buildings and the plantation on a false cutting limit the extent of the view. The sensitivity of the visual receptor is Moderate.
Change in view during construction
The former Flintshire County Council depot would be demolished and removed from view. Other parts of the road network would be visible to first floor rooms, in particular from even numbered properties backing onto the A494.
Magnitude of visual change
Part of the Scheme would be perceptible during construction. Duration is short term (less than 5 years), and distance is near (less than 0.5 km). Magnitude of change is judged as minor adverse.
Significance of visual effect
Combining moderate visual sensitivity and minor adverse magnitude of visual impact, the significance of effect on representative viewpoint 12 is judged as Slight adverse.

13 – Dundas Street
From the pavement opposite 51 Dundas Street and at the gable end of 58 Queen Street. It represents the view available to pedestrians using Dundas Street and residential properties backing onto the A494. The sensitivity of the visual receptor is Moderate.
Change in view during construction
A view of the embankment plantation at the western approach to the Dee Bridge that is visible through the railway bridge portal would be removed from view. The road lighting columns positioned in the central reserve of the realigned route, would replace the ones visible through the bridge portal. Ende terrace properties also have a south-westward view towards the former depot and Bridge Houses, which would be removed.

13 – Dundas Street
Magnitude of visual change
Part of the Scheme would be readily apparent during construction. Duration is short term (less than 5 years), and distance is near (less than 0.5 km). Magnitude of change is judged as moderate adverse
Significance of visual effect
Combining moderate visual sensitivity and moderate adverse magnitude of visual impact, the significance of effect on representative viewpoint 13 is judged as Moderate adverse.

14 – Northern Gateway development site
From a newly created amenity and surface water attenuation area adjacent to new build residential area. This viewpoint replaces the Farm Road viewpoint as the new development interrupts the westward view from the estate that was built to provide housing for Shotton Steel workers. Representative of the view available to users of local public open space of limited importance. The sensitivity of the visual receptor is Low.
Change in view during construction
Garden City sign gantry would be removed from view and road lighting columns would be shifted away from the view to the replacement bridge alignment. The view of other A494 road elements is screened by a mature hedgerow next to the riverside path and trees at eastern approach to Bascule Bridge. There may be a view of plant used to construct replacement bridge and remove existing bridge.
Magnitude of visual change
A very small part of the Scheme would be perceptible during construction. Duration is short term (less than 5 years), and distance is near (less than 0.5 km). Magnitude of change is judged as negligible adverse.
Significance of visual effect
Combining low visual sensitivity and negligible adverse magnitude of visual impact, the significance of effect on representative viewpoint 14 is judged as Neutral.

15 – Pentre Trade Park
From the grassed area near to the entrance to Pentre Trade Park. The view is representative of the view available to retail workers and visitors to the trade park, users of main roads and cyclists using the National Cycle Network. The sensitivity of the visual receptor is Low.
Change in view during construction
The former council depot would be removed from view. Disused dwellings are screened from view by hedge next to Queensferry Drain and planting around the wholesale retail unit car park. Evergreen trees visible at the end of the footpath would be removed from view as the realigned drain open channel is excavated. The Queensferry Autos site is screened from view by vegetation surrounding Dry Bridge Farm. There would be a view of construction activity at the end of Chester Road East.
Magnitude of visual change
A small part of the Scheme would be perceptible during construction. Duration is short term (less than 5 years), and distance is near (less than 0.5 km). Magnitude of change is judged as minor adverse.
Significance of visual effect
Combining low visual sensitivity and minor adverse magnitude of visual impact, the significance of effect on representative viewpoint 15 is judged as Slight adverse.

16 – Station Road (Expressway Business Park)
From a grassed area opposite the entrance to the builders' merchants in the business park. It represents the view available to office and retail workers and visitors to the business park. The sensitivity of the visual receptor is Low.
Change in view during construction
Lombardy poplar trees at the western approach to the bridge would be removed to accommodate the reprofiling of the embankment and improvement to Public Footpath West Saltney 7, after the removal of the bridge abutment.

16 – Station Road (Expressway Business Park)
Magnitude of visual change
Visual elements would be removed as a consequence of the Scheme during construction. Duration is short term (less than 5 years), and distance is near (less than 0.5 km). Magnitude of change is judged as minor adverse.
Significance of visual effect
Combining low visual sensitivity and minor adverse magnitude of visual impact, the significance of effect on representative viewpoint 16 is judged as Slight adverse.

17 – Pentre
From the road verge near to the gable end of 2 Mechanics Lane in Pentre. It represents the view from dwellings facing Chester Road East in a less densely populated area towards the retail park, and users of busy county roads. The sensitivity of the visual receptor is Low.
Change in view during construction
The demolition of the former council depot would be visible as it is gradually removed from view, which would reveal properties behind on Queen Street. Trees and vegetation alongside Chester Road East and around the wholesale retail unit car park would interrupt the view of construction activities at Bridge Houses.
Magnitude of visual change
A very small part of the Scheme would be perceptible during construction. Duration is short term (less than 5 years), and distance is near (less than 0.5 km). Magnitude of change is judged as negligible adverse.
Significance of visual effect
Combining low visual sensitivity and negligible adverse magnitude of visual impact, the significance of effect on representative viewpoint 17 is judged as Neutral.

18 – Bascule Bridge
From the pavement on the bridge. The view is representative of one experienced by pedestrians crossing the bridge shared with traffic and an NCN route on the B5441 Station Road/Welsh Road. The Wales Coast Path crosses the Bascule Bridge. The view towards the A494 is indirect to the direction of travel. The views northward and downriver from Bascule Bridge are more interesting and feature Hawarden Bridge, Flintshire Bridge, Connah's Quay Power Station and Shotton Steelworks. Hawarden Bridge provides another pedestrian crossing point shared with a cycle way. The sensitivity of the visual receptor is Moderate.
Change in view during construction
The Garden City sign gantry visible on the eastern side of the bridge would be removed. Trees visible on the western side of the bridge would be removed to facilitate the removal of the western approach abutment and widening of Public Footpath West Saltney 7 after the dismantling of the River Dee bridge. The view of the replacement bridge construction would be partially interrupted by the existing bridge, but there would be a view of the plant used in the construction of the replacement bridge piles, bridge pier cap, bridge beams and both abutments. Once the replacement bridge is open to traffic, there would be an uninterrupted view of the plant used to remove the existing bridge and supporting elements. The replacement bridge would be higher than the existing so that safety standards for forward visibility over the bridge can be achieved. The removal of the vegetation and Riverside Works buildings would be conspicuous and reveal more of the SPEN depot on Factory Road. The construction of new embankments would be visible from the viewpoint but the hedgerow on the western embankment of the Dee would filter the view. Lighting columns would be restored on the bridge Construction vehicles would be a conspicuous feature and construction activities would draw the viewer's attention. The replacement of the bridge is the key feature of the Scheme.

18 – Bascule Bridge
Magnitude of visual change
The construction works would become the dominant feature of the view. Size and scale of change is major, duration is short term (less than 5 years), and distance is near (less than 0.5 km). Magnitude of change is judged as Major adverse.
Significance of visual effect
Combining moderate visual sensitivity and major adverse magnitude of visual impact, the significance of effect on representative viewpoint 18 is judged as Large adverse.

19 – Welsh Road
From the pavement on Welsh Road to the east of the Bascule Bridge. The view is representative of a transient one experienced by road users including pedestrians and cyclists. The view to the A494 is indirect to the direction of travel. The sensitivity of the visual receptor is Low.
Change in view during construction
Plant used in the construction of the replacement bridge would be partially visible, interrupted by buildings and the existing bridge. Once construction of the replacement bridge is complete the removal of the existing would proceed, which would be partially visible from this location.
Magnitude of visual change
Size and scale of change is moderate (the works would be a noticeable feature of the view), duration is short term (less than 5 years), and distance is near (less than 0.5 km). Magnitude of change is judged as Moderate adverse.
Significance of visual effect
Combining low visual sensitivity and moderate adverse magnitude of visual impact, the significance of effect on representative viewpoint 19 is judged as Slight adverse.

20 – Claremont Avenue / Wales Coast Path
From the north embankment footpath in-between the Bascule and Dee bridges. The path is part of the Wales Coast Path and the Burton Marsh Greenway (also part of the NCN). The view is representative of a transient view for users of nationally promoted rights of way, and also one available from less densely populated areas. The sensitivity of the visual receptor is Moderate.
Change in view during construction
Trees visible on the western side of the bridge would be removed to facilitate the replacement bridge western approach and bridge abutment. The view of the replacement bridge construction would be partially interrupted by the existing bridge, but there would be a view of the plant used in the construction of the replacement bridge piles, bridge pier cap, bridge beams and the western abutment. Once the replacement bridge is open to traffic, there would be an uninterrupted view of the plant used to remove the existing bridge. The replacement bridge would be higher than the existing so that safety standards for forward visibility over the bridge can be achieved. The replacement of the and Riverside Works buildings would be conspicuous and reveal more of the Factory Road industrial areas. Lighting columns would be restored on the bridge Construction vehicles would be a conspicuous feature and construction activities would draw the viewer's attention. The replacement of the bridge is the key feature of the Scheme.
Magnitude of visual change
The construction works would become the dominant feature of the view. Size and scale of change is major, duration is short term (less than 5 years), and distance is near (less than 0.5 km). Magnitude of change is judged as Major adverse.
Significance of visual effect
Combining moderate visual sensitivity and major adverse magnitude of visual impact, the significance of effect on representative viewpoint 20 is judged as Large adverse.

21 – Chemistry Lane / Factory Road
From the junction of Chemistry Lane and Factory Road near to where Chemistry Lane passes beneath the Chester and Holyhead railway line. The view is representative of one experienced by users of public footpaths of limited importance (West Saltney paths 3, 6 and 15 meet here), road users and industrial workers. The sensitivity of the visual receptor is Low.
Change in view during construction
A shared use path would be constructed along the line of Chemistry Lane, nearer to the SPEN depot side to avoid the root protection zones of the Lombardy poplar and Black poplar hybrid trees within the grounds of the sewage treatment works that are protected by TPO. The small trees that is next to the SPEN boundary fence, grass and tall herbs would be removed. Machinery associated with the construction and surfacing of the path would be visible.
Magnitude of visual change
This would be a very small part of the Scheme, and the activity would be a minor one to tie-in and improve the non-traffic connections. Duration is short term (less than 5 years), and distance is near (less than 0.5 km). Magnitude of change is judged as minor adverse.
Significance of visual effect
Combining low visual sensitivity and minor adverse magnitude of visual impact, the significance of effect on representative viewpoint 21 is judged as Slight adverse.

22 – Wales Coast Path
From the Wales Coast Path and Burton Marsh Greenway, at the junction with a shared use path that connects the River Dee to Foxes Lane and Sealand Road. The broad and uninterrupted view is representative of a transient one experienced by users of nationally promoted rights of way and cyclists using the path for leisure or commuting. The sensitivity of the visual receptor is Moderate.

22 – Wales Coast Path
Change in view during construction
Preparatory works would see the removal of the haulage yard buildings at Riverside Works and the removal of the trees seen on the south-facing embankment slopes of the A494 to the western side of the river and vegetation east of the river. The arable field on the eastern side of the path is being considered for use as a construction site compound and would be near to this viewpoint. There would be an uninterrupted view of site cabins and welfare units, construction vehicles and plant, and material stockpiles. The approach embankments for the replacement bridge would be newly constructed on the western side of the river and expanded to the eastern side to accommodate the shared use path connecting to existing paths in Sealand. A replacement pumping station and culvert for Queensferry Drain would be constructed on the site of the Riverside Works haulage yard. The construction of the replacement bridge is a key feature of the Scheme. Construction vehicles would be a conspicuous feature and construction activities would draw the viewer's attention. Once the replacement bridge is put into place, works to remove the existing bridge deck and support beams would take place. The newly constructed replacement bridge would interrupt much of the activities associated with removing the existing bridge. Lighting columns would be restored on the bridge and the sign gantry would no longer be required and removed.
Magnitude of visual change
The size and scale of change during construction would be major and the activities would become the dominant feature of the view. Duration is short term (less than 5 years), and distance is near (less than 0.5 km). Magnitude of change is judged as major adverse.
Significance of visual effect
Combining moderate visual sensitivity and major adverse magnitude of visual impact, the significance of effect on representative viewpoint 22 is judged as Large adverse.

23 – Aston Quay landing stage
From an informal amenity area near to the remains of Aston Quay (near West Saltney path 7). The broad and uninterrupted view is representative of one experienced by users of public footpaths. The sensitivity of the visual receptor is Moderate.
Change in view during construction
Preparatory works would see the removal of vegetation seen to the south facing embankment slopes of the A494 to the eastern side of the river. The arable field on the eastern side of the river is being considered for use as a construction site compound and would be near to this viewpoint. There would be an uninterrupted view of site cabins and welfare units, construction vehicles and plant, and material stockpiles. The construction of the approach embankments for the replacement bridge would be screened from view by scrub woodland. On the eastern side, the embankment would be altered to accommodate a shared use path. The construction of the replacement bridge is a key feature of the Scheme. Construction plant working from the river would be a conspicuous feature and construction activities would draw the viewer's attention. Once the replacement bridge is put into place, removal of the existing bridge deck and support beams would proceed. The newly constructed replacement bridge would interrupt much of the view of the dismantling activities associated with removal of the existing bridge. Lighting columns would be restored on the bridge and the sign gantry would be removed.
Magnitude of visual change
The size and scale of change during construction would be moderate and the activities would be readily apparent to the viewer. Duration is short term (less than 5 years), and distance is near (less than 0.5 km). Magnitude of change is judged as moderate adverse.
Significance of visual effect
Combining moderate visual sensitivity and moderate adverse magnitude of visual impact, the significance of effect on representative viewpoint 23 is judged as Moderate adverse.

24 – Ferrybank Farm
From a shared use path running parallel to the A494 that connects Foxes Lane to the Wales Coast Path/Burton Marsh Greenway along the Dee Canal northern embankment, near to Ferrybank Farm. Represents a transient view available to pedestrians and cyclists, outdoor workers and static view from less densely populated areas from flat lowland reclaimed saltmarsh. The sensitivity of the visual receptor is Low.
Change in view during construction
Preparatory works would see the removal of the haulage yard building and embankment plantation on the western side of the river to accommodate the western approach embankment and channel for the outfall of Queensferry Drain. Vegetation seen to the right-hand side of the view would be removed to enable access for construction from the A494 and to accommodate a shared use path. The swale would require reprofiling to accommodate road surface water within a shorter length. The arable field on the left-hand side of the view is being considered for use as a construction site compound and would be near to this viewpoint. There would be an uninterrupted view of site cabins and welfare units, construction vehicles and plant, and material stockpiles. The construction of the replacement bridge is a key feature of the Scheme and would be visible ahead of the viewer. Construction plant working from the river would be a noticeable feature and construction activities would be readily apparent. Once the replacement bridge is put into place, removal of the existing bridge would proceed. Lighting columns would be restored on the bridge and the sign gantry would be removed.
Magnitude of visual change
The size and scale of change during construction would be major and the activities would become a dominant feature of the view. Duration is short term (less than 5 years), and distance is near (less than 0.5 km). Magnitude of change is judged as major adverse.
Significance of visual effect
Combining low visual sensitivity and major adverse magnitude of visual impact, the significance of effect on representative viewpoint 24 is judged as Moderate adverse.

25 – Rector's Lane footbridge
From a footbridge crossing the Chester and Holyhead railway line and Public Footpath Hawarden 5. Pedestrian connection between Rector's Lane/Chester Road industry and Factory Road industry. Representative of the view available to users of footpaths of limited importance within industrial areas in an area of flat lowland reclaimed saltmarsh. The sensitivity of the visual receptor is Low.
Change in view during construction
The view of construction activities would be interrupted by semi-natural woodland alongside the railway line and large-scale buildings within the Factory Road industrial area.
Magnitude of visual change
There would be no change in view.
Significance of visual effect
Combining low visual sensitivity and no change magnitude of visual impact, the significance of effect on representative viewpoint 25 is judged as Neutral.

26 – Willans and Robinson landing stage
From an informal amenity area and public footpath (West Saltney path 7), near to the remains of a landing stage associated with the Grade II listed factory buildings. The factory once manufactured specialist steels before becoming a munitions factory during World War I. The broad and uninterrupted view is representative of one experienced by users of public footpaths and workers at Factory Road. The sensitivity of the visual receptor is Moderate.

26 – Willans and Robinson landing stage
Change in view during construction
Preparatory works would see the removal of vegetation seen to the south facing embankment slopes of the A494 to the western and eastern side of the river. The arable field on the eastern side of the river is being considered for use as a construction site compound. There would be an uninterrupted view of site cabins and welfare units, construction vehicles and plant, and material stockpiles. The construction of the approach embankments for the replacement bridge would be visible. On the eastern side, the embankment would be altered to accommodate a shared use path, and a temporary ramp would be built to allow construction access from the A494. The construction of the replacement bridge is a key feature of the Scheme. Construction plant working from the river would be a noticeable feature and construction activities would draw the viewer's attention. Once the replacement bridge is put into place, removal of the existing bridge would proceed. The newly constructed replacement bridge would interrupt much of the view of the dismantling activities associated with removal of the existing bridge. Lighting columns would be restored on the bridge and the Garden City sign gantry would be removed.
Magnitude of visual change
The size and scale of change during construction would be moderate and the activities would be readily apparent to the viewer. Duration is short term (less than 5 years), and distance is near (less than 0.5 km). Magnitude of change is judged as Moderate adverse.
Significance of visual effect
Combining moderate visual sensitivity and moderate adverse magnitude of visual impact, the significance of effect on representative viewpoint 23 is judged as Moderate adverse.

27 – Foxes Lane
From the footpath that runs alongside Foxes Lane near to the junction with Manor Road. Representative of the view available to outdoor workers, users of footpaths of limited importance and road users in a flat open reclaimed saltmarsh landscape. The sensitivity of the visual receptor is Low.

27 – Foxes Lane
Change in view during construction
Preparatory works would see the removal of the haulage yard building and embankment plantation on the western side of the river to accommodate the western approach embankment and channel for the outfall of Queensferry Drain. Vegetation seen on the south facing A494 embankment east of the river would be removed to construct a temporary construction access ramp and to accommodate a connection between the replacement bridge and the foot and cycle path network. The arable field in the foreground is being considered for use as a construction site compound and would be near to this viewpoint. There would be an uninterrupted view of site cabins and welfare units, construction vehicles and plant, and material stockpiles. The construction of the replacement bridge is a key feature of the Scheme, the construction plant working from the river may be visible, depending on the layout of the site compound. Once the replacement bridge is put into place, removal of the existing bridge would proceed. Lighting columns would be restored on the bridge and the sign gantry would be removed.
Magnitude of visual change
The size and scale of change during construction would be moderate and the activities would be readily apparent to the viewer. Duration is short term (less than 5 years), and distance is near (less than 0.5 km). Magnitude of change is judged as Moderate adverse.
Significance of visual effect
Combining low visual sensitivity and moderate adverse magnitude of visual impact, the significance of effect on representative viewpoint 27 is judged as Slight adverse.

28 – Sealand Embankment
From a shared use path running parallel to the A494, which connects Sealand Road to Foxes Lane. The viewpoint is located near to the boundary of 16 Sealand Road. It represents the view available to pedestrians and cyclists and residents of Sealand Road with an indirect view towards the Scheme. The sensitivity of the visual receptor is Low.

28 – Sealand Embankment
Change in view during construction
A view of construction activities would be interrupted by the A494 embankment.
Magnitude of visual change
There would be no change in view.
Significance of visual effect
Combining low visual sensitivity and no change magnitude of visual impact, the significance of effect on representative viewpoint 28 is judged as Neutral.

29 – Manor Road
From a field access gateway opposite 11 West Green on Manor Road. It represents the view from residents within less densely populated areas with northward aspects. The sensitivity of the visual receptor is Low.
Change in view during construction
Preparatory works would see the removal of the embankment plantation on the western side of the river to accommodate the western approach embankment and channel for the outfall of Queensferry Drain. Vegetation seen on the south facing A494 embankment east of the river would be removed to construct a temporary construction access ramp and to accommodate a connection between the replacement bridge and the foot and cycle path network. The arable field beyond Foxes Lane and Ferrybank Farm is being considered for use as a construction site compound and would be near to this viewpoint. The view of site cabins and welfare units, construction vehicles and plant, and material stockpiles would be partially interrupted by buildings and trees at Ferrybank Farm. The construction of the replacement bridge is a key feature of the Scheme, the construction plant working from the river may be visible, depending on the layout of the site compound. Once the replacement bridge is put into place, removal of the existing bridge would proceed. Lighting columns would be restored on the bridge and the sign gantry would be removed.

29 – Manor Road
Magnitude of visual change
The size and scale of change during construction would be minor and the activities would be perceptible to the viewer. Duration is short term (less than 5 years), and distance is near (less than 0.5 km). Magnitude of change is judged as Minor adverse.
Significance of visual effect
Combining low visual sensitivity and minor adverse magnitude of visual impact, the significance of effect on representative viewpoint 29 is judged as Slight adverse.

Visual receptors

9.6.7 The detailed assessment of the potential construction effects upon views from residential properties is set out in Appendix 9-E Visual Effects. Properties are shown on Figure 9.11 Visual Effects. 'Direct' views arise where the Scheme or changes are directly in front of habitable rooms in the building façade. 'Indirect' views arise where the Scheme or changes are observed only from non-habitable rooms (e.g. bathrooms) or from outside the building.

9.6.8 The bare ground ZTV analysing a digital terrain model does not take account of surface features and visual obstructions such as buildings and substantial vegetation. For the purposes of informing the assessment of significant visual effects in a built-up area, a more refined ZTV analysis covering a more localised area is required. Use of Welsh Government LiDAR digital surface model data allows the visibility analysis to take account of substantial surface features when generating a ZTV.

Receptors in LCA11 – River Dee Reclaimed Agriculture, Sealand Manor
Ferrybank Farm (2SH), Sealand Manor Farm and the Paddock (2SB) are predicted to experience a view of the construction site compound including site offices, welfare units, construction plant, construction vehicles and material stockpiles from outdoor spaces.

Receptors in LCA11 – River Dee Reclaimed Agriculture, Sealand Manor
Preparatory works
There would be a view of the removal of trees and buildings near to Riverside Works on the western bank of the river from outdoor spaces.
Earthworks
There would be a view of the excavation of a new channel for Queensferry Drain and construction of the replacement bridge approach embankment from outdoor spaces.
Structures
The replacement bridge is a key feature of the Scheme. Construction activities associated with it would draw the viewer's attention when seen from outdoor spaces.
Magnitude of visual impact
For Ferrybank Farm the magnitude of visual impact is judged as moderate adverse. For Sealand Manor Farm and The Paddock the magnitude of visual impact is judged as minor adverse.
Significance of visual effect
The significance of visual effect would be Moderate adverse for Ferrybank farm and Slight adverse for Sealand Manor Farm and The Paddock.

Receptors in LCA28 – Queensferry, Chemistry Lane Industry and Sewage Works
Dwellings in Riverside Caravan Park (2DU) are predicted to experience a view of construction activities from outdoor spaces. The vacant site next to the caravan park is being considered for use as a construction site compound.
Preparatory works
There would be a view of works associated with the removal of trees and buildings at Riverside Works from outdoor spaces.
Earthworks
There would be a view of the excavation of a new outfall to accommodate the Queensferry Drain and the construction of the replacement bridge's western approach embankment available form outdoor spaces.

Receptors in LCA28 – Queensferry, Chemistry Lane Industry and Sewage Works
Structures
Construction of a replacement pumping station and the replacement bridge would be visible from outdoor spaces, so too the removal of the original structures. The Riverside Way access to the caravan park would be reconfigured to provide improved visibility at the junction, deceleration and acceleration slip roads and turning areas.
Magnitude of visual impact
The magnitude of visual impact is judged as Moderate adverse.
Significance of visual effect
The significance of visual effect would be Moderate adverse.

Receptors in LCA29 – Chester Road Industry and Pentre Trade Park
Drybridge Farm (2AA) is predicted to experience a view of construction work. The former amenity site and garages site is being considered for temporary use as a construction site compound.
Preparatory works
There would be a view of the demolition of Queensferry Autos, Bridge Houses and the former council depot, this would open up a view of the A494, and an indirect view towards the Chester and Holyhead railway. A group of trees near to Bridge Houses would be removed in advance of earthworks.
Earthworks
There would be a view of the ground excavation create the Queensferry Drain open channel and a maintenance track, and ground preparation for the construction of a shared use path.
Structures
The termination of Chester Road East would be reconfigured to restrict motor vehicle access onto the shared use path. There would be a view of the construction of drainage head walls and fences to restrict access at Queensferry Drain.

Receptors in LCA29 – Chester Road Industry and Pentre Trade Park
Magnitude of visual impact
Construction vehicles and works activities would be conspicuous elements in the view. The magnitude of visual impact is judged as moderate adverse.
Significance of visual effect
The significance of visual effect would be moderate adverse.

Receptors in LCA30 – Queensferry, Factory Road Industry
Dwellings at the Dundas Sidings site (2DD) would experience a view of the construction activities associated with the improvement of unsurfaced footpaths to shared use path. and construction vehicles would be conspicuous elements.
Preparatory works
There would be a view of trees next to the SPEN depot site boundary being removed.
Earthworks
There would be a view of the ground preparation for the construction of a shared use path.
Structures
Installation of barriers to restrict motor vehicle access to the shared use path and surfacing works.
Magnitude of visual impact
The magnitude of visual impact is judged as minor adverse.
Significance of visual effect
The significance of visual effect would be slight adverse.

Receptors in LCA31 – Queensferry, Station Road Industry
Dwellings at Bridge Villas (2TA) would experience the view of preparatory works and key construction work from first floor rooms.
Preparatory works
The removal of plantations and Lombardy poplar trees next to the A494 would reveal views of traffic during construction.

Receptors in LCA31 – Queensferry, Station Road Industry
Earthworks
The alteration of the existing western approach embankment and ground preparation to construct a shared use path would largely be interrupted by retail buildings.
Structures
The River Dee Bridge would be replaced in the view and positioned further upriver. The Garden City sign gantry would be removed from view. Activities associated with works to structures would be visible.
Magnitude of visual impact
The magnitude of visual impact is judged as minor adverse.
Significance of visual effect
The significance of visual effect would be slight adverse.

Receptors in LCA32 – Queensferry Town Centre
Dwellings on Queen Street with odd numbers (1TB.1, 1TB.2 and 1TB.3) have frontages facing the A494. Dwellings on Queen Street with even numbers (1TB.4) back onto the A494. Dundas Street properties face towards Queensferry Junction and back onto the Chester and Holyhead railway embankment. Dwellings on Dundas Street numbered 17 to 45 (1SZ.1) would experience, from the street, an indirect glimpse of construction activities. Dwellings on Dundas Street numbered 47 to 51 (1SZ.2) would have a direct view of works from the front and rear.

Receptors in LCA32 – Queensferry Town Centre
Preparatory works
For 1TB.1 and 1TB.2 there would be a view of the demolition of the depot building, which is a visual detractor, to enable the construction of the Queensferry Drain open channel. Construction vehicles would be conspicuous elements in the view, and the buildings and plantations on the opposite side of the street would slightly interrupt the view. For 1TB.3, buildings on the opposite side of the street would moderately interrupt the view of demolition works. For 1TB.4 there would be an open and uninterrupted view of the demolition of the former depot and an indirect view of the removal of Bridge Houses. For 1SZ.1 the view would be limited by neighbouring properties. For 1SZ.2 there would be an uninterrupted view of the demolition of the former council depot, and an indirect view of the demolition of Bridge Houses.
Earthworks
Excavation of the open channel for the Queensferry Drain would be the significant earthworks west of the Chester and Holyhead railway line. A view of Construction activity would be available form first floor rooms and viewed across the A494. Construction vehicles would be conspicuous elements in the view.
Structures
Culverts and headwalls to tie-in the Queensferry Drain open channel with underground sections would be significant structures west of the Chester and Holyhead railway line. A view of Construction activity would be available form first floor rooms and viewed across the A494. Construction vehicles would be conspicuous elements in the view.

Receptors in LCA32 – Queensferry Town Centre
Magnitude of visual impact
For views from Queen Street 3 to 17 (1TB.1), which are partially interrupted by an engineered landform and existing buildings, the magnitude of visual impact is judged as minor adverse. For Queen Street 21 to 41 (1TB.2), views are partially interrupted by existing buildings, the magnitude of visual impact is judged as moderate adverse. For Queen Street 43 to 61 (1TB.3), views are moderately interrupted by existing buildings, the magnitude of visual impact is judged as negligible adverse. For Queen Street 38 to 58 (1TB.4) the magnitude of visual impact is judged as moderate adverse. For Dundas Street 17 to 45 (1SZ.2) the magnitude of impact is judged as negligible adverse. For Dundas Street 47 to 51 (1SZ.2) the magnitude of visual impact is judged as moderate adverse.
Significance of visual effect
For Queen Street 3 to 17 (1TB.1) and 43 to 61 (1TB.3) the significance of visual effect would be slight adverse. For Queen Street 21 to 41 (1TB.2) and 38 to 58 (1TB.4) the significance of visual effect would be moderate adverse. For Dundas Street 17 to 55 (1SZ.1) the significance of visual effect would be neutral. For Dundas Street 47 to 51 (1SZ.2) the significance of visual effect would be moderate adverse.

Receptors in LCA37 – Sealand, Garden City Residential Area
Dwellings 3 to 17 (2SN.1) on Claremont Avenue back onto the River Dee. Dwellings 2 to 44 (2SN.3) and 46 to 64 (2SN.2) face the A494 embankment.
Preparatory works
For 2SN.1 trees visible on the western side of the bridge would be removed to facilitate the regrading of the western approach embankment. The regrading of the embankment would occur after the construction of the replacement bridge. For 2SN.2 the view of construction activities would be moderately interrupted by neighbouring buildings, and for 2SN.3 the indirect view would be interrupted by buildings and vegetation.

Receptors in LCA37 – Sealand, Garden City Residential Area
Earthworks
For 2SN.1, the level of the replacement bridge approach embankments would be higher than existing so that safety standards for forward visibility over the bridge can be achieved.
Structures
The construction of the replacement would be partially interrupted by the existing bridge. Works to dismantle the existing bridge would be conspicuous in views. Lighting columns would be restored to the replacement bridge. Construction plant and vehicles would be a conspicuous feature and construction activities would draw the viewer's attention. The bridge is the key feature of the Scheme.
Magnitude of visual impact
For 2SN.1 the magnitude of visual impact is judged as moderate adverse. For 2SN.2 negligible adverse and for 2SN.3 no change.
Significance of visual effect
For 2SN.1 the significance of visual effect would be moderate adverse, for 2SN.2 slight adverse and for 2SN.3 neutral.

Receptors in LCA39 – Sealand Manor Settlement
View overlooking reclaimed marshland used as agriculture towards the Garden City. Ground floor views from West Green (2SD) are interrupted by a roadside hedge, but first floor rooms overlook the hedge and experience a view of the existing A494.
Preparatory works
Part of arable field to west of Foxes Lane and near to the A494 is being considered for temporary use as a construction site compound. The roadside hedge along Manor Road would screen the view from ground floor rooms. From first floor rooms there would an indirect and partially interrupted view of site cabins and welfare units, construction vehicles and plant, and material. Works associated with the removal of ornamental trees at the western approaches to the Dee bridge, and the demolition of buildings at Riverside Works would be only partially visible from first floor rooms.

Receptors in LCA39 – Sealand Manor Settlement
Earthworks
There would be a glimpse of the alteration to the embankment to accommodate a ramp connecting the bridge with the local cycle and path network available from first floor rooms.
Structures
A glimpse of the construction of the replacement bridge would be available from first floor rooms. The Garden City sign gantry would be removed.
Magnitude of visual impact
The magnitude of visual impact is judged as minor adverse.
Significance of visual effect
The significance of visual effect would be slight adverse.

Summary of visual effects during construction

9.6.9 7 representative viewpoints are predicted to experience a significant adverse effect during construction. Table 9-14 presents a summary of the assessment of construction effects.

Table 9-14 Visual effects during construction

Ref	Location	Visual sensitivity	Magnitude of impact	Significance of effect
1	Lower Aston Hall Lane	Low	Negligible beneficial	Neutral
2	Hawarden Bridge	Moderate	Minor adverse	Slight adverse
3	Rowley's Drive	Low	Minor adverse	Neutral
4	Dee View	Moderate	No change	Neutral
5	Chevron's Road footbridge	Moderate	No change	Neutral
6	Clay Hill Farm	Low	No change	Neutral
7	Queensferry town centre	Low	No change	Neutral

Ref	Location	Visual sensitivity	Magnitude of impact	Significance of effect
8	Old Hall Farm	Moderate	Minor adverse	Slight adverse
9	Hawarden Cemetery	Moderate	Negligible beneficial	Neutral
10	Plantation near to Pembroke Close	Low	Moderate adverse	Slight adverse
11	Greenacres Farm	Moderate	No change	Neutral
12	Queen Street	Moderate	Minor adverse	Slight adverse
13	Dundas Street	Moderate	Moderate adverse	Moderate adverse
14	Northern Gateway development site	Low	Negligible adverse	Neutral
15	Pentre Trade Park	Low	Minor adverse	Slight adverse
16	Station Road (Expressway Business Park)	Low	Minor adverse	Slight adverse
17	Pentre	Low	Negligible adverse	Neutral
18	Bascule Bridge	Moderate	Major adverse	Large adverse
19	Welsh Road	Low	Moderate adverse	Slight adverse
20	Claremont Avenue / Wales Coast Path	Moderate	Major adverse	Large adverse
21	Chemistry Lane / Factory Road	Low	Minor adverse	Slight adverse
22	Wales Coast Path	Moderate	Major adverse	Large adverse
23	Aston Quay landing stage	Moderate	Moderate adverse	Moderate adverse

Ref	Location	Visual sensitivity	Magnitude of impact	Significance of effect
24	Ferrybank Farm	Low	Major adverse	Moderate adverse
25	Rector's Lane footbridge	Low	No change	Neutral
26	Willans and Robinson landing stage	Moderate	Moderate adverse	Moderate adverse
27	Foxes Lane	Low	Moderate adverse	Slight adverse
28	Sealand Embankment	Low	No change	Neutral
29	Manor Road	Low	Minor adverse	Slight adverse

9.6.10 Representative viewpoints judged to experience a neutral significance of effect during construction would not be predicted to experience a significant adverse or beneficial effect during operation, even if the magnitude of impact were Major. The construction phase sees the largest magnitude of changes to views. The following viewpoints have been filtered out from the assessment of operational effects due to their visual separation from the Scheme.

a) RV1 Lower Aston Hall Lane.
b) RV3 Rowley's Drive.
c) RV4 Dee View.
d) RV5 Chevron's Road footbridge.
e) RV6 Clay Hill Farm.
f) RV7 Queensferry Town Centre.
g) RV9 Hawarden Cemetery.
h) RV11 Greenacres Farm.
i) RV14 Northern Gateway development site.
j) RV17 Pentre.
k) RV25 Rector's Lane footbridge.
l) RV28 Sealand Embankment.

9.6.11 57 dwellings are predicted to experience a significant adverse effect during construction. These dwellings have a direct view of the A494 and/or are immediately adjacent to the construction elements. Table 9-15 presents a summary of the assessment of construction effects on residential receptors.

Table 9-15 Residential receptors (construction)

Ref	Location	Visual sensitivity	Magnitude of impact	Significance of effect
2SH	Ferrybank Farm [1 nr]	High	Moderate adverse	Moderate adverse
2SB	Sealand Manor farm and The Paddock [2 nr]	Moderate	Minor adverse	Slight adverse
2DU	Riverside Caravan Park [22 nr]	Moderate	Moderate adverse	Moderate adverse
2AA	Drybridge Farm [1 nr]	Moderate	Moderate adverse	Moderate adverse
2DD	Dundas Sidings [6 nr]	Moderate	Minor adverse	Slight adverse
2TA	Bridge Villas [4 nr]	Moderate	Minor adverse	Slight adverse
1TB.1	3 to 17 (odds) Queen Street [8 nr]	Moderate	Minor adverse	Slight adverse
1TB.2	21 to 41 (odds) Queen Street [11 nr]	Moderate	Moderate adverse	Moderate adverse
1TB.3	43 to 61 (odds) Queen Street [10 nr]	Moderate	Negligible adverse	Slight adverse
1TB.4	38 to 58 (evens) Queen Street [11 nr]	Moderate	Moderate adverse	Moderate adverse
1SZ.1	17 to 45 (odds) Dundas Street [14 nr]	Moderate	Negligible adverse	Neutral
1SZ.2	47 to 51 (odds) Dundas Street [3 nr]	Moderate	Moderate adverse	Moderate adverse

Ref	Location	Visual sensitivity	Magnitude of impact	Significance of effect
2SN.1	3 to 17 (odds) Claremont Avenue [8 nr]	Moderate	Moderate adverse	Moderate adverse
2SN.2	46 to 64 (evens) Claremont Avenue [10 nr]	Moderate	Negligible adverse	Slight adverse
2SN.3	2 to 44 (evens) Claremont Avenue [22 nr]	Moderate	No change	Neutral
2SD	1 to 10 West Green [10 nr]	Moderate	Minor adverse	Slight adverse

9.7 Assessment of Operational Effects

Landscape effects during operation

9.7.1 This assessment considers the landscape effects of the Scheme during the operational phase. Refer to Tables 9-7 to 9-10 for the assessment of sensitivity of the baseline landscape.

LCA11 – River Dee Reclaimed Agriculture, Sealand Manor
The sensitivity of this character area to the Scheme is Medium. This is based on flat and open agricultural landscape of reclaimed saltmarsh deemed to be of moderate scenic quality. The A494 is next to this character area from Dee Bridge to Garden City Junction. The area is locally designated as Green Barrier.
Impacts on physical characteristics
The 0.4 ha of land within the permanent highway boundary would become part of the landscape and nature conservation mitigation of LCA45. The 3.3 ha of land outside of the highway boundary would be restored to arable farmland.
Impacts on perceptual characteristics
The view of road elements and traffic would be restored, but without the Garden City sign gantry. The replacement bridge would be near to where the existing bridge stood and a view of it would readily be available from the north-western portion of this character area.

LCA11 – River Dee Reclaimed Agriculture, Sealand Manor
Impacts on historic and cultural characteristics
The setting of Ferry Bank Farm listed building would be restored to the existing situation.
The magnitude of impact is judged as negligible adverse. In combination with medium landscape sensitivity, the significance of effect on LCA11 is judged as Neutral.

LCA28 – Queensferry, Chemistry Lane Industry and Sewage Works
The sensitivity of this LCA to the Scheme is Low. This is based on a level and open landscape deemed to be of low scenic quality. The area has been developed in the past, fallen into disuse and then redeveloped. The A494 is next to this LCA from the Chester and Holyhead railway line to the River Dee. A row of Lombardy poplar and black poplar hybrid trees situated next to Chemistry Lane are protected by a TPO. There are several relics of the area's industrial heritage such as landing stages and jetties.
Impacts on physical characteristics
Land within the permanent highway boundary would become part of the landscape and nature conservation mitigation and carriageway of LCA45. The realigned Queensferry Drain would run in parallel to the westbound carriageway, as in the existing situation. Footpaths would link into the shared use path network, improved surface finish and the removal of obstacles would make paths more easily accessible. The layout of roads and buildings would be changed from the existing situation, but there would not be an addition of new uncharacteristic features.
Impacts on perceptual characteristics
Noise barriers would increase levels of tranquillity for Riverside Works and Riverside Caravan Park.
Impacts on historic and cultural characteristics
Non-designated historic assets would be permanently lost during construction. There would be no further erosion of historic assets during operation.

LCA28 – Queensferry, Chemistry Lane Industry and Sewage Works
The magnitude of impact is judged as negligible beneficial. In combination with low landscape sensitivity, the significance of effect on LCA28 is judged as Neutral.

LCA29 – Queensferry, Chester Road Industry and Pentre Trade Park
The sensitivity of this character area to the Scheme is Low. This is based on a level and enclosed townscape deemed to be of low scenic quality. The A494 is next to this character area from Queensferry Junction to the Chester and Holyhead line. Part of the area is within the Deeside Enterprise Zone. The Scheme would directly affect this area
Impacts on physical characteristics
Land within the permanent highway boundary would become part of the landscape and nature conservation mitigation of LCA45, including the open channel section of Queensferry Drain that would run in parallel to the westbound carriageway. A shared use path would connect Queensferry town centre and Chester Road East to the River Dee and Sealand, re-introducing non-motorised traffic to the road corridor (footpaths alongside the A494 and across Dee Bridge had been closed). The layout of side roads and buildings would be changed from the existing situation, but there would not be an addition of new uncharacteristic features.
Impacts on perceptual characteristics
There would be no change to levels of tranquillity. The additional non-motorised activity would cause no noticeable change to the landscape.
Impacts on historic and cultural characteristics
There would be no detrimental effect on features of historic and cultural importance within the area.
The magnitude of impact is judged as negligible beneficial. In combination with low landscape sensitivity, the significance of effect on LCA29 is judged as Neutral.

LCA30 – Queensferry, Factory Road Industry
The sensitivity of this character area to the Scheme is Low. This is based on a level and enclosed townscape, deemed to be of low scenic quality. The area is developed and is part of the Deeside Enterprise Zone. Buildings associated with the former Queensferry Wireworks are Grade II listed.
Impacts on physical characteristics
Improvements to footpaths on Chemistry Lane may result in increased access on foot and by bike as links through to Garden City and Queensferry from Factory Road and Chester Road would be more direct and not shared with traffic.
Impacts on perceptual characteristics
Improved pedestrian and cycle access may increase activity and movement along Chemistry Lane. This is a busy area with frequent access for occupation. The additional activity would cause no noticeable change to the landscape. The replacement bridge would replace the existing bridge in views and the removal of the Garden City sign gantry would reduce the amount of road infrastructure structures in the view, but lighting columns would be restored to the bridge.
Impacts on historic and cultural characteristics
Very little remains of the Aston colliery railway on the surface. The setting of the listed buildings would not be affected by the Scheme.
Combining low landscape sensitivity and no change magnitude of impact, the significance of effect on LCA30 is judged as Neutral.

LCA31 – Queensferry, Station Road Industry
The sensitivity of this character area to the Scheme is Low. This is based on a level and enclosed townscape deemed to be of low scenic quality. The area is developed as a mixture of retail, office and training sites with a small cluster of dwellings next to the Bascule Bridge, which is a Grade II listed structure (also listed in the community of Sealand).

LCA31 – Queensferry, Station Road Industry
Impacts on physical characteristics
Improvements to the footpath connecting Station Road to Riverside Way/Chemistry Lane and the consequence of the removal of the western bridge abutment would create a more open character at the rear of the car sales and service unit.
Impacts on perceptual characteristics
Improved pedestrian and cycle access between Station Road and Riverside Way/Chemistry Lane may see an increase in non-motor use. Widening of the path would make it less claustrophobic and threatening and encourage its use. The removal of vegetation and the bridge abutment would open up views towards the replacement bridge, but the embankment and difference in level would screen the view of traffic.
Impacts on historic and cultural characteristics
There would be greater separation between the Bascule and Dee Bridges which would improve its setting.
Combining low landscape sensitivity and negligible beneficial magnitude of impact, the significance of effect on LCA30 is judged as Neutral.

LCA32 – Queensferry Town Centre
The sensitivity of this character area to the Scheme is Low. This is based on a level and enclosed townscape of low scenic quality. The Queensferry War Memorial Institute building is Grade II listed, and a row of trees alongside Hurlbutt's Drive are protected by a TPO. Residential areas are concentrated at the south-eastern portion of the character area, the side closest to the existing A494 and proposed works.
Impacts on physical characteristics
The reduction in the amount of urban form within the adjoining area would not have an impact on Queensferry Town Centre. No change.
Impacts on perceptual characteristics
Buildings in views southward would be replaced by an open water channel and paths. There would be no change to the levels of tranquillity within the character area.

LCA32 – Queensferry Town Centre
Impacts on historic and cultural characteristics
The setting of Queensferry War Memorial Institute would not be affected by the Scheme.
Combining low landscape sensitivity and no change magnitude of impact, the significance of effect on LCA32 is judged as Neutral.

LCA37 – Sealand, Garden City Residential Area
The sensitivity of this LCA to the Scheme is low. This is based on a flat lowland and enclosed townscape deemed to be of low scenic quality. The A494 corridor divides this LCA into one section that has developed along Welsh Road and another that has developed along the A548 Sealand Road. Part of the LCA, the development on Sealand Road, is locally designated as Green Barrier. The Bascule Bridge is a Grade II listed structure (also listed in the community of Queensferry).
Impacts on physical characteristics
There would be no change in the amount of urban form within an adjacent area during operation.
Impacts on perceptual characteristics
The existing bridge in views southward would be replaced, the replacement bridge would be moved away from the residential area slightly upriver. The carriageway would also be moved further away and with it, traffic and lighting columns. With the removal of the sign gantry and reduced view of traffic, there may be a very minor noticeable improvement to levels of tranquillity.
Impacts on historic and cultural characteristics
There would be no detrimental impact on the setting of Bascule Bridge. An uninterrupted view of it would be available from a larger area.
Combining low landscape sensitivity and negligible beneficial magnitude of impact, the significance of effect on LCA37 is judged as Neutral.

LCA39 – Sealand Manor Settlement
The sensitivity of this character area to the Scheme is Medium. This is based on a level and open townscape deemed to be of moderate scenic quality. The area is locally designated as Green Barrier.
Impacts on physical characteristics
There would be no change to the landform or landcover of this character area.
Impacts on perceptual characteristics
The replacement River Dee Bridge would be a conspicuous feature of north-westward views from properties facing Manor Road, replacing existing features of the view. There would be no change to levels of tranquillity.
Impacts on historic and cultural characteristics
There would be no impact on historic or cultural features within the area.
Combining medium landscape sensitivity and no change magnitude of impact, the significance of effect on LCA39 is judged as Neutral.

LCA45 – A494, Queensferry Junction to Deeside Park Junction
The sensitivity of this character area to the Scheme is Low. This is based on a level and open transport corridor deemed to be of low scenic quality. The Scheme would directly affect this character area.
Impacts on physical characteristics
West of the River Dee the road corridor would extend into the neighbouring LCA to the south. There would be a repositioning of hard landscape elements due to the shift in alignment. Additional land would be incorporated into the transport corridor character area for the benefit of landscape and nature conservation mitigation. Replacement elements would be characteristic of a transport corridor
Impacts on perceptual characteristics
The removal of roadside vegetation would open up views into the surrounding landscape until replacement planting has time to mature. The road corridor is the main source of noise and movement affecting neighbouring character areas. There would be no change to levels of tranquillity within the character area.

LCA45 – A494, Queensferry Junction to Deeside Park Junction
Impacts on historic and cultural characteristics
The view of Bascule Bridge from the A494 would be opened up and be set further away. There would be no further detrimental effect on features of historic and cultural importance within the character area.
Combining low landscape sensitivity and no change magnitude of impact, the significance of effect on LCA45 is judged as Neutral.

LCA50 – River Dee Canal, Saltney Ferry to Wepre Gutter
The sensitivity of this character area to the Scheme is High. This is based on a lowland level and open landscape deemed to be of low scenic quality. The River Dee is statutorily protected for nature conservation. Bascule Bridge and Hawarden Bridge are Grade II listed buildings, in addition there are several jetties, landing stages, quays and pill boxes of historic interest. The earthwork embankments are used as non-traffic routes that connect to National Cycle Network, Wales Coast Path and other promoted routes. The Scheme would directly affect this LCA.
Impacts on physical characteristics
A small area of saltmarsh would be shaded by the replacement bridge. Where the original bridge stood, the riverbank previously shaded out would be allowed to regenerate naturally. There would be no detrimental impact on community connectivity as the Scheme would introduce new paths that improve on the existing situation creating more opportunity to walk and cycle to nearby destinations.
Impacts on perceptual characteristics
The replacement bridge carrying traffic over the River Dee is a key feature of the Scheme. The bridge would not change the existing character, but it would provide greater separation between Dee Bridge and Bascule Bridge. Removal of roadside vegetation to accommodate bridge approach embankments would make them more conspicuous until new planting has matured.

LCA50 – River Dee Canal, Saltney Ferry to Wepre Gutter
Impacts on historic and cultural characteristics
There would be no further erosion of historic features associated with Aston Quay during operation. The setting for Bascule Bridge would be slightly improved with greater separation between bridges.
Combining high landscape sensitivity and minor adverse magnitude of impact, the significance of effect on LCA50 is judged as moderate adverse reducing to slight adverse when planting has matured.

9.7.2 The River Dee Canal is predicted to experience a significant and medium-term effect during operation reducing to a not significant long-term effect after mitigation planting has matured. Table 9-15 presents a summary of the assessment of operational effects on the landscape resource.

Table 9-16 Landscape effects during operation

Ref	Location	Landscape sensitivity	Magnitude of impact	Significance of effect
11	River Dee Reclaimed Agriculture, Sealand Manor	Low	Negligible adverse	Neutral
28	Queensferry, Chemistry Lane Industry and Sewage Works	Low	Negligible beneficial	Neutral
29	Queensferry, Chester Road Industry and Pentre Trade Park	Low	Negligible beneficial	Neutral
30	Queensferry, Factory Road Industry	Low	No change	Neutral
31	Queensferry, Station Road Industry	Low	Negligible beneficial	Neutral
32	Queensferry Town Centre	Low	No change	Neutral
37	Sealand, Garden City Residential Area	Low	Negligible beneficial	Neutral
39	Sealand Manor Settlement	Medium	No change	Neutral

Ref	Location	Landscape sensitivity	Magnitude of impact	Significance of effect
45	A494, Queensferry Junction to Deeside Park Junction	Low	No change	Neutral
50	River Dee Canal, Saltney Ferry to Wepre Gutter	High	Minor adverse	Moderate adverse reducing to Slight adverse

Visual effects during operation

9.7.3 As with the construction phase effects, the effects of the operational phase upon views from the representative viewpoints and residential properties identified by the study have been assessed.

9.7.4 'Direct' views arise where the Scheme or changes are directly in front of habitable rooms in the building façade. 'Indirect' views arise where the Scheme or changes are observed only from non-habitable rooms (e.g. bathrooms), or from outside the building.

9.7.5 The assessment of the sensitivity of the representative viewpoints to the Scheme is presented in Appendix 9-D. Representative viewpoints carried forward for assessment during operation are presented as annotated photographs within Figures 9.14 to 9.30.

9.7.6 The detailed assessment of the potential operational effects upon views from residential properties is set out in Appendix 9-E. These properties are shown on Figure 9.11 to 9.13 and are cross-referenced to the Appendix 9-E with a unique number. The predicted significance of effect for each receptor or receptor group is shown graphically on these plans for three Scheme stages, which are construction, year of opening (year 1), and design year (year 15).

Representative viewpoints

2 – Hawarden Bridge (Refer to Figure 9.14)
From National Cycle Network route 5 and Public Footpath West Saltney 12. Represents static views from flat lowland engineered landscape and transient views from users of regional designated routes. Photograph taken from ramp to Hawarden Bridge crossing. The sensitivity of the visual receptor is Moderate.
Change in view during year of opening (year 1)
The Garden City sign gantry would have been removed. There would be greater separation between the Bascule Bridge and Dee Bridge, and main line traffic would be slightly further from view. Lighting columns would be restored to the bridge. Negligible beneficial.
Change in view during design year (year 15)
The River Dee flood plain is devoid of significant vegetation, and no planting is proposed on the riverbank. There would be no noticeable change from Year 1. Negligible beneficial.
Magnitude of visual impact and significance of visual effect
Magnitude of visual impact judged as negligible beneficial for year of opening and design year. The significance of effect would be Neutral.

8 – Old Hall Farm (Refer to Figure 9.15)
From Public Footpath West Saltney 8, near to The Lodge and Old Hall Farm. The view is representative of one experienced by users of public footpaths and countryside workers from a flat and open lowland landscape. Wales Coast Path runs in parallel to the footpath 8 sharing an alignment with Public Footpath West Saltney 16 along the riverbank. The sensitivity of the visual receptor is Moderate.
Change in view during year of opening (year 1)
The Garden City sign gantry would have been removed. There would be greater separation between the Bascule Bridge and Dee Bridge, and main line traffic would be slightly further from view. Lighting columns would be restored to the bridge. Negligible beneficial.

8 – Old Hall Farm (Refer to Figure 9.15)
Change in view during design year (year 15)
The River Dee flood plain is devoid of significant vegetation, and no planting is proposed on the riverbank. There would be no noticeable change from Year 1. Negligible beneficial.
Magnitude of visual impact and significance of visual effect
Magnitude of visual impact judged as negligible beneficial for year of opening and design year. The significance of effect would be Neutral.

10 – Plantation near to Pembroke Close (Refer to Figure 9.16)
From a footpath linking the series of streets branching from Dyfed Drive and Chester Road East to Queensferry town centre. It represents a static view available to a less densely populated area and a transient view for users of public open space of limited importance. The sensitivity of the visual receptor is Low.
Change in view during year of opening (year 1)
Bridge Houses would have been removed. The area considered for temporary used as a site compound would be available for future development. Improved path network may see more foot and cycle activity. No change.
Change in view during design year (year 15)
Shrub planting proposed beside Chester Road East may be visible but would be a barely noticeable change to the view. No change.
Magnitude of visual impact and significance of visual effect
Magnitude of visual impact judged as no change for year of opening and design year. The significance of effect would be Neutral.

12 – Queen Street (Refer to Figure 9.17)
From the pavement outside of 21 Queen Street. It represents the view available to dense residential areas facing the A494. Unused buildings and the plantation on a false cutting limit the extent of the view. The sensitivity of the visual receptor is Moderate.

12 – Queen Street (Refer to Figure 9.17)
Change in view during year of opening (year 1)
The former Flintshire County Council would have been removed. High sided vehicles and lighting columns would be visible. Trees next to the westbound carriageway may need to be removed if damage during construction is unavoidable. Overall, change would be negligible beneficial.
Change in view during design year (year 15)
Committed mitigation and enhancement planting would be noticeable benefits to the view but would not mitigate the view of the A494 itself. Negligible beneficial.
Magnitude of visual impact and significance of visual effect
Magnitude of visual impact judged as negligible beneficial for year of opening and design year. The significance of effect would be slight beneficial.

13 – Dundas Street (Refer to Figure 9.18)
From the pavement opposite 51 Dundas Street and at the gable end of 58 Queen Street. It represents the view available to pedestrians using Dundas Street and residential properties backing onto the A494. The sensitivity of the visual receptor is Moderate.
Change in view during year of opening (year 1)
Plantation and part of Garden City sign gantry visible through railway bridge portal would have been removed. High sided vehicles, lighting columns and speed enforcement camaras visible. No change from existing situation.
Change in view during design year (year 15)
Committed mitigation and enhancement planting would be noticeable benefits to the view but would not mitigate the view of the A494 itself. Negligible beneficial.
Magnitude of visual impact and significance of visual effect
Magnitude of visual impact judged as no change for year of opening and negligible beneficial for design year. The significance of effect would be Neutral improving to slight beneficial.

15 – Pentre Trade Park (Refer to Figure 9.19)
From the grassed area near to the entrance to Pentre Trade Park. The view is representative of the view available to retail workers and visitors to the trade park, users of main roads and cyclists using the National Cycle Network. The sensitivity of the visual receptor is Low.
Change in view during year of opening (year 1)
The former council depot would have been removed. No other element of the Scheme would be visible. Removal of the depot building would reveal a view of properties on Queen Street/Dundas Street. Negligible beneficial.
Change in view during design year (year 15)
Committed mitigation would have matured and reached a height where it would filter a view of the wholesalers from Queen Street/Dundas Street. This would also filter the view of the Queens Street/Dundas Street from this location. No change.
Magnitude of visual impact and significance of visual effect
Magnitude of visual impact judged as negligible beneficial for year of opening and no change for design year. The significance of effect would be Slight beneficial deteriorating to Neutral.

16 – Station Road (Expressway Business Park) (Refer to Figure 9.20)
From a grassed area opposite the entrance to the builders' merchants in the business park. It represents the view available to office and retail workers and visitors to the business park. The sensitivity of the visual receptor is Low.
Change in view during year of opening (year 1)
The filtered view of A494 traffic seen through gaps in-between building would be moved further from view, as would the road lighting columns. Negligible beneficial.
Change in view during design year (year 15)
Planting in the area that was previously road surface would reinforce the hedgerow at the boundary between the business park and the A494 and interrupt the previously filtered view of road traffic. Minor beneficial.

16 – Station Road (Expressway Business Park) (Refer to Figure 9.20)
Magnitude of visual impact and significance of visual effect
Magnitude of visual impact judged as negligible beneficial for year of opening and minor beneficial for design year. The significance of effect would be Slight beneficial.

18 – Bascule Bridge
From the pavement on the bridge. The view is representative of one experienced by pedestrians crossing the bridge shared with traffic and an NCN route on the B5441 Station Road/Welsh Road. The Wales Coast Path crosses the Bascule Bridge. The view towards the A494 is indirect to the direction of travel. The sensitivity of the visual receptor is Moderate.
Change in view during year of opening (year 1)
The Garden City sign gantry would have been removed and the existing bridge piers retained. The replacement bridge would be slightly further from the viewer but remain as the focal point of the view. There would be a view of traffic and lighting columns. Bridge approach embankments would appear as an extension of the existing earthworks and not a new and uncharacteristic feature. There would be an increase of engineered elements within the river channel. Negligible adverse.
Change in view during design year (year 15)
Planting on embankments would soften the view of the bridge approaches and provide a barrier to a view of traffic. The bridge would remain as the focal point of the view. No change.
Significance of visual effect
Magnitude of visual impact judged as negligible adverse for year of opening and no change for design year. The significance of effect would be Slight adverse during year of opening improving to Neutral by design year.

19 – Welsh Road
From the pavement on Welsh Road to the east of the Bascule Bridge. The view is representative of a transient one experienced by road users including pedestrians and cyclists. The view to the A494 is indirect to the direction of travel. The sensitivity of the visual receptor is Low.
Change in view during year of opening (year 1)
The replacement bridge beams and parapet would not be visible from this location. There may be a view of high sided vehicles and lighting columns. Negligible beneficial.
Change in view during design year (year 15)
Planting to soften the approach embankments would not be visible from this location. The view would remain unchanged. Negligible beneficial.
Magnitude of visual impact and significance of visual effect
Magnitude of visual impact judged as negligible beneficial for year of opening and for design year. The significance of effect would be Slight beneficial.

20 – Claremont Avenue / Wales Coast Path
From the north embankment footpath in-between the Bascule and Dee bridges. The path is part of the Wales Coast Path and the Burton Marsh Greenway (also part of the NCN). The view is representative of a transient view for users of nationally promoted rights of way, and also one available from less densely populated areas. The sensitivity of the visual receptor is Moderate.
Change in view during year of opening (year 1)
There would be a clear and uninterrupted view of the retained piers, replacement bridge and traffic. The view would resemble the existing situation but with wider paths passing beneath the bridges on each riverbank and additional engineered elements within the river channel. The retained existing and proposed bridge piers would be visually dominant particularly during low tides when the bridge piles are visible. Garden City sign gantry would have been removed and lighting columns restored to the bridge. Moderate adverse.

20 – Claremont Avenue / Wales Coast Path
Change in view during design year (year 15)
Planting to soften bridge approach embankments would filter views of traffic approaching the bridge. The Dee Bridge would be the focus of views when travelling upriver. Minor adverse.
Magnitude of visual impact and significance of visual effect
Magnitude of visual impact judged as moderate adverse for year of opening and minor adverse for design year. The significance of effect would be Moderate adverse during year of opening improving to Slight adverse by design year.

21 – Chemistry Lane / Factory Road
From the junction of Chemistry Lane and Factory Road near to where Chemistry Lane passes beneath the Chester and Holyhead railway line. The view is representative of one experienced by users of public footpaths of limited importance (West Saltney paths 3, 6 and 15 meet here), road users and industrial workers. The sensitivity of the visual receptor is Low.
Change in view during year of opening (year 1)
The neglected path would have been widened for improved pedestrian and cycle access and connecting to a surfaced path network at the River Dee and to Station Road. Self-sown trees would have been removed from the boundary fence which would open up the view along the disused railway line towards the river. Grassland, tall herbs and perennials would be retained alongside the path for biodiversity interest. Negligible beneficial.
Change in view during design year (year 15)
No planting is proposed alongside the shared use path. There would be no change in view from year of opening. Negligible beneficial.
Magnitude of visual impact and significance of visual effect
Magnitude of visual impact judged as negligible beneficial for year of opening and negligible beneficial for design year. The significance of effect would be Neutral.

22 – Wales Coast Path
From the Wales Coast Path and Burton Marsh Greenway, at the junction with a shared use path that connects the River Dee to Foxes Lane and Sealand Road. The broad and uninterrupted view is representative of a transient one experienced by users of nationally promoted rights of way and cyclists using the path for leisure or commuting. The sensitivity of the visual receptor is Moderate.
Change in view during year of opening (year 1)
The replacement bridge would be a key feature of the view and resemble that of the existing bridge, but slightly nearer to the viewing position. The inclusion of a shared use path to the upriver side of the replacement bridge would move the view of high sided vehicles and cars away from the bridge parapet. The combination of safety barrier between traffic and pedestrians and bridge parapet may interrupt the view of cars on the bridge. Traffic travelling westbound on the eastern bridge approach embankment would be visible, the basic road restraint system proposed would not screen the view of cars. West of the river, a noise barrier is proposed for the benefit of residents in Riverside Caravan Park, which would screen the view of cars. The Garden City sign gantry would have been removed, existing bridge piers retained, and lighting columns restored to the bridge. Queensferry Drain outfall would be restored to the view as a headwall instead of an inlet. Both adverse and beneficial visual elements, which are characteristic of a road corridor. Moderate adverse.
Change in view during design year (year 15)
Planting on bridge approach embankments would have matured, which would help soften the appearance of the engineered slopes and integrate the replacement bridge into the river corridor. The replacement bridge would remain the key feature of the view and the view of it would resemble the view of the existing bridge, but with a reconfiguration of safety barriers, lighting columns and the introduction of drainage headwall/outfall structures and ramp connecting riverside paths to the bridge. Minor adverse.
Magnitude of visual impact and significance of visual effect
Magnitude of visual impact judged as moderate adverse for year of opening and minor adverse for design year. The significance of effect would be Moderate adverse at year of opening and improving to Slight adverse by design year.

23 – Aston Quay landing stage
From an informal amenity area near to the remains of Aston Quay (near West Saltney path 7). The broad and uninterrupted view is representative of one experienced by users of public footpaths. The sensitivity of the visual receptor is Moderate.
Change in view during year of opening (year 1)
The replacement bridge would be a key feature of the view and resemble that of the existing bridge, but slightly nearer to the viewing position. The inclusion of a shared use path to the upriver side of the replacement bridge would move the view of high sided vehicles and cars away from the bridge parapet. The combination of safety barrier between traffic and pedestrians and bridge parapet may interrupt the view of cars on the bridge. Traffic travelling westbound on the eastern bridge approach embankment would be visible, the basic road restraint system proposed would not screen the view of cars. The Garden City sign gantry would have been removed, and lighting columns would be restored to the bridge. Some adverse and beneficial changes to the view, the elements of which are characteristic of a road corridor. Minor adverse
Change in view during design year (year 15)
Planting on the eastern bridge approach embankment would have matured, which would help soften the appearance of the engineered slopes and integrate the replacement bridge into the river corridor. The replacement bridge would remain the key feature of the view and the view of it would resemble the view of the existing bridge, but with a reconfiguration of safety barriers and lighting columns and the introduction of a ramp connecting riverside paths to the bridge. Negligible adverse.
Magnitude of visual impact and significance of visual effect
Magnitude of visual impact judged as minor adverse for year of opening and negligible adverse for design year. The significance of effect would be Slight adverse at year of opening and improving to Neutral by design year.

24 – Ferrybank Farm
From a shared use path running parallel to the A494 that connects Foxes Lane to the Wales Coast Path/Burton Marsh Greenway along the Dee Canal northern embankment, near to Ferrybank Farm. Represents a transient view available to pedestrians and cyclists, outdoor workers and static view from less densely populated areas from flat lowland reclaimed saltmarsh. The sensitivity of the visual receptor is Low.
Change in view during year of opening (year 1)
Planting removed to enable access for construction from the A494 and the addition of a ramp to provide a link between riverside paths and the bridge would leave the embankment slope bare and restore the view of traffic and safety barriers. There would be a wider margin to the field side of the path to provide connectivity and cover for wildlife. The swale to the roadside of the path would be reprofiled to control the changes in surface water runoff brought about by the addition of a ramp. There would be an increase in the area of path surface that is visible and a very slight reduction in arable land. The sign gantry would be removed from view, and the replacement bridge would resemble the existing bridge. Moderate adverse.
Change in view during design year (year 15)
When replacement planting on the embankment slope has matured the visual filter that it provides would restore the view of traffic to one that resembles the existing situation. There would be more diversity of elements in the foreground view with the introduction of the wildlife corridor, which would have the undesired effect of blocking off the views across the open landscape. A mix of adverse and beneficial visual elements. Negligible adverse.
Magnitude of visual impact and significance of visual effect
Magnitude of visual impact judged as moderate adverse for year of opening and negligible adverse for design year. The significance of effect would be Slight adverse at year of opening and improving to Neutral by design year.

26 – Willans and Robinson landing stage
From an informal amenity area and public footpath (West Saltney path 7), near to the remains of a landing stage associated with the Grade II listed factory buildings. The factory once manufactured specialist steels before becoming a munitions factory during World War I. The broad and uninterrupted view is representative of one experienced by users of public footpaths and workers at Factory Road. The sensitivity of the visual receptor is Moderate.
Change in view during year of opening (year 1)
The replacement bridge would be a key feature of the view and resemble that of the existing bridge, but slightly nearer to the viewing position. The inclusion of a shared use path to the upriver side of the replacement bridge would move the view of high sided vehicles and cars away from the bridge parapet. The combination of safety barrier between traffic and pedestrians and bridge parapet may interrupt the view of cars on the bridge. Traffic travelling westbound on the eastern bridge approach embankment would be visible, the basic road restraint system proposed would not screen the view of cars. The Garden City sign gantry would have been removed, and lighting columns would be restored to the bridge. Some adverse and beneficial changes to the view, the elements of which are characteristic of a road corridor. Minor adverse
Change in view during design year (year 15)
Planting on the eastern bridge approach embankment would have matured, which would help soften the appearance of the engineered slopes and integrate the replacement bridge into the river corridor. The replacement bridge would be a key feature of the view and the view of it would resemble the view of the existing bridge, but with a reconfiguration of safety barriers and lighting columns and the introduction of a ramp connecting riverside paths to the bridge. Negligible adverse.
Magnitude of visual impact and significance of visual effect
Magnitude of visual impact judged as minor adverse for year of opening and negligible adverse for design year. The significance of effect would be Slight adverse at year of opening and improving to Neutral by design year.

27 – Foxes Lane
From the footpath that runs alongside Foxes Lane near to the junction with Manor Road. Representative of the view available to outdoor workers, users of footpaths of limited importance and road users in a flat open reclaimed saltmarsh landscape. The sensitivity of the visual receptor is Low.
Change in view during year of opening (year 1)
Planting removed to enable access for construction from the A494 and the addition of a ramp to provide a link between riverside paths and the bridge would leave the embankment slope bare and restore the view of traffic and safety barriers. Traffic travelling westbound on the eastern bridge approach embankment would be visible, the basic road restraint system proposed would not screen the view of cars. West of the river, a noise barrier is proposed for the benefit of residents in Riverside Caravan Park, which would screen the view of cars. The sign gantry would be removed from view, and light columns would be restored to the bridge. The replacement bridge would resemble the existing bridge. Minor adverse.
Change in view during design year (year 15)
Planting on the embankment next to westbound traffic would have matured, which would help soften the appearance of the engineered slopes, filter views of road traffic and integrate the replacement bridge into the river corridor. The replacement bridge would be a key feature of the view, and the view of it would resemble the view of the existing bridge. Negligible adverse.
Magnitude of visual impact and significance of visual effect
Magnitude of visual impact judged as minor adverse for year of opening and negligible adverse for design year. The significance of effect would be Slight adverse at year of opening and improving to Neutral by design year.

29 – Manor Road
From a field access gateway opposite 11 West Green on Manor Road. It represents the view from residents within less densely populated areas with northward aspects. The sensitivity of the visual receptor is Low.

29 – Manor Road
Change in view during year of opening (year 1)
Planting removed to enable access for construction from the A494 and the addition of a ramp to provide a link between riverside paths and the bridge would leave the embankment slope bare and restore the view of traffic and safety barriers. Traffic travelling westbound on the eastern bridge approach embankment would be visible. The sign gantry would be removed from view, and light columns would be restored to the bridge. The replacement bridge would resemble the existing bridge. Minor adverse.
Change in view during design year (year 15)
Planting on the embankment next to westbound traffic would have matured, which would help soften the appearance of the engineered slopes and filter views of road traffic resembling the original view. The replacement bridge would be a noticeable feature of the view, and the view of it would resemble the view of the existing bridge. No change.
Magnitude of visual impact and significance of visual effect
Magnitude of visual impact judged as minor adverse for year of opening and no change for design year. The significance of effect would be Slight adverse at year of opening and improving to Neutral by design year

Visual receptors

Receptors in LCA11 – River Dee Reclaimed Agriculture, Sealand Manor
Ferrybank Farm (2SH), Sealand Manor Farm and the Paddock (2SB).
Change in view during year of opening (year 1)
For 2SH there would be an indirect view of the replacement bridge, A494 embankment, traffic and lighting columns available from the building and outdoor spaces. Site of compound restored to agricultural use. For 2SB There would be a view of the replacement bridge, road traffic and lighting columns available from outdoor spaces.

Receptors in LCA11 – River Dee Reclaimed Agriculture, Sealand Manor
Change in view during design year (year 15)
For 2SH there would be an indirect view of the replacement bridge, A494 embankment, traffic, and lighting columns available from the building and outdoor spaces. Committed mitigation planting with landscape integration objectives would filter the view of road traffic. For 2SB there would be a view of the replacement bridge, road traffic and lighting columns available from outdoor spaces. Committed mitigation planting with landscape integration objectives would filter the view of traffic on the approaches to the bridge
Magnitude of visual impact and significance of visual effect
For 2SH the magnitude of impact is judged as moderate adverse at year of opening and minor adverse at design year. The significance of effect would be moderate adverse at year of opening and improving to slight adverse by design year. For 2SB the magnitude of impact is judged as minor adverse at year of opening and no change at design year. The significance of effect would be slight adverse at year of opening and improving to neutral by design year.

Receptors in LCA28 – Queensferry, Chemistry Lane Industry and Sewage Works
1 to 22 Riverside Caravan Park, Riverside Way, Queensferry (2DU).
Change in view during year of opening (year 1)
View of westbound carriageway embankment and lighting columns available from outdoor spaces. View of traffic screened by noise barrier.
Change in view during design year (year 15)
Planting with nature conservation and landscape integration objectives would filter the view of noise barrier on embankment, including traffic and lighting columns.

Receptors in LCA28 – Queensferry, Chemistry Lane Industry and Sewage Works
Magnitude of visual impact and significance of visual effect
For 2DU the magnitude of impact is judged as moderate adverse at year of opening and minor adverse at design year. The significance of effect would be moderate adverse at year of opening and improving to slight adverse by design year.

Receptors in LCA29 – Chester Road Industry and Pentre Trade Park
Drybridge Farm, Chester Road East, Mancot (2AA)
Change in view during year of opening (year 1)
The road surface, safety barriers, traffic and lighting columns would be visible in views from first floor rooms as is the existing situation.
Change in view during design year (year 15)
Planting with objective to enhance built environment would soften the view of hard elements such as road surfacing, kerbs, retaining walls and safety barriers. Planting with nature conservation objective to provide habitat connectivity between Chester Road East and the railway line would contribute to a visual filter of the road and road elements.
Magnitude of visual impact and significance of visual effect
For 2AA the magnitude of impact is judged as minor adverse at year of opening and at design year. The significance of effect would be neutral at year of opening and design year.

Receptors in LCA30 – Queensferry, Factory Road Industry
Dundas Sidings, Factory Road, Pentre (2DD).
Change in view during year of opening (year 1)
The shared use path would increase the built elements in the view from outdoor spaces. There would be a view of pedestrians and cyclists using the path from outdoor spaces.

Receptors in LCA30 – Queensferry, Factory Road Industry
Change in view during design year (year 15)
The shared use path would increase the built elements in the view from outdoor spaces. There would be a view of pedestrians and cyclists using the path from outdoor spaces.
Magnitude of visual impact and significance of visual effect
For 2DD the magnitude of impact is judged as negligible adverse at year of opening and at design year. The significance of effect would be neutral at year of opening and design year.

Receptors in LCA31 – Queensferry, Station Road Industry
1 to 4 Bridge Villas, Station Road, Queensferry (2TA).
Change in view during year of opening (year 1)
A view of traffic, lighting columns and Dee Bridge would be available to first floor rooms, although the view of traffic would be partially interrupted by buildings. Ornamental hedge would interrupt the view of traffic and Dee Bridge from ground floor rooms and outdoor spaces.
Change in view during design year (year 15)
Committed mitigation measures with visual screen objectives would interrupt the view of traffic at the western approach to the replacement bridge. The view of lighting columns, including those restored to the Dee bridge would be available.
Magnitude of visual impact and significance of visual effect
For 2TA the magnitude of impact is judged as minor adverse at year of opening and neutral by design year. The significance of effect would be slight adverse reducing to neutral by design year.

Receptors in LCA31 – Queensferry, Station Road Industry
Queen Street numbered 3 to 17 (1TB.1), 21 to 41 (1TB.2), 43 to 61 (1TB.3), and 38 to 58 (1TB.4). Dundas Street numbered 17 to 45 (1SZ.1), and 47 to 51 (1SZ.2).

Receptors in LCA31 – Queensferry, Station Road Industry
Change in view during year of opening (year 1)
For 1TB.1 and 1TB.3 high sided vehicles and light columns would be visible in an indirect view. For 1TB.2 high sided vehicles and light columns would be visible in a direct view. For 1TB.4 road surface, safety barriers and cars would be visible to first floor rooms. High sided vehicles and lighting columns would be visible from ground floor, partially interrupted by brick wall. For 1SZ.1 there would be an indirect view of high sided vehicles and lighting columns available from the street and rear gardens. For 1SZ.2 there would be a view of high sided vehicles and lighting columns available from street and gardens. Views from first floor would feature the road surface and cars in addition to high sided vehicles and lighting columns.
Change in view during design year (year 15)
No mitigation planting is proposed in-between the edge of the settlement and the A494 due to the lack of space. Planting between Queensferry Drain and Pentre Trade Park would help filter the view of the wholesaler unit.
Magnitude of visual impact and significance of visual effect
For Queen Street odd numbered dwellings (1TB.1, 1TB.2 and 1TB.3), and Dundas Street 1SZ.1, the magnitude of visual impact is judged as no change for both opening year and design year, and the significance of visual effect would be Neutral. For 1TB.4 and 1SZ.2 the magnitude of visual impact is judged as no change for year of opening and negligible beneficial for design year, and the significance of visual effect would be neutral at year of opening slightly improving to slight beneficial by design year.

Receptors in LCA37 – Sealand, Garden City Residential Area
3 to 17 (2SN.1), 46 to 64 (2SN.2) and 2 tot 44 (2SN.3), Claremont Avenue, Sealand West.

Receptors in LCA37 – Sealand, Garden City Residential Area
Change in view during year of opening (year 1)
For 2SN.1 the replacement bridge would be upriver of the existing bridge replacing it in the view. A view of traffic travelling on embankment west of the bridge would be uninterrupted for a short section. The new features and elements that would be added to the view are characteristic of the existing transport corridor. For 2SN.2 the view of the replacement bridge and traffic would be moderately interrupted by buildings. For 2SN.3 the view would resemble the existing situation, and the view of traffic would be interrupted by the embankment, a plantation and a timber fence.
Change in view during design year (year 15)
For 2SN.1 The Scheme and committed mitigation measures would be noticeable and key features of the view. Planting at the western approaches to the bridge would screen the view of traffic. The view would be restored to one that is similar to the existing situation but with the reintroduction of lighting columns on the bridge. For 2SN.2 and 2SN.3 there would be no change to the view when compared to the view available at year of opening.
Magnitude of visual impact and significance of visual effect
For 2SN.1 the magnitude of impact is judged as moderate adverse at year of opening and minor adverse by design year. The significance of effect would be moderate adverse reducing to slight adverse by design year. For 2SN.2 and 2SN.3 the magnitude of impact is judged as no change at both year of opening and at design year. The significance of effect would be neutral.

Receptors in LCA39 – Sealand Manor Settlement
1 to 10, West Green, Sealand East (2SD).
Change in view during year of opening (year 1)
There would be an indirect view of the replacement bridge, A494 embankment, traffic and lighting columns available from first floor rooms.

Receptors in LCA39 – Sealand Manor Settlement
Change in view during design year (year 15)
There would be an indirect view of the replacement bridge, A494 embankment, traffic, and lighting columns available from first floor rooms. Existing vegetation and committed mitigation planting on the embankment of the A494 would filter views of traffic.
Magnitude of visual impact and significance of visual effect
For 2SD the magnitude of impact is judged as no change for both year of opening and by design year. The significance of effect would be neutral.

Summary of visual effects during operation

Representative viewpoints

9.7.7 Table 9-17 presents a summary of the predicted effects during year of opening (Y1), and design year (Y15). 2 representative viewpoints are predicted to experience a significant adverse effect during year of opening scenario. By the design year scenario the significance of effect is predicted to improve.

9.7.8 In the table below Y = Year, N = Negligible, S = Slight, Mi = Minor, Mo = Moderate.

Table 9-17 Visual effects during operation

Ref	Location	Visual sensitivity	Magnitude of impact	Significance of effect
2	Hawarden Bridge	Moderate	Y1 N beneficial Y15 N beneficial	Y1 Neutral Y15 Neutral
8	Old Hall Farm	Moderate	Y1 N beneficial Y15 N beneficial	Y1 Neutral Y15 Neutral
10	Plantation near to Pembroke Close	Low	Y1 No change Y15 No change	Y1 Neutral Y15 Neutral
12	Queen Street	Moderate	Y1 N beneficial Y15 N beneficial	Y1 S beneficial Y15 S beneficial
13	Dundas Street	Moderate	Y1 No change Y15 N beneficial	Y1 Neutral Y15 S Beneficial

Ref	Location	Visual sensitivity	Magnitude of impact	Significance of effect
15	Pentre Trade Park	Low	Y1 N beneficial Y15 No change	Y1 S beneficial Y15 Neutral
16	Station Road (Expressway Business Park)	Low	Y1 N beneficial Y15 N beneficial	Y1 S beneficial Y15 S beneficial
18	Bascule Bridge	Moderate	Y1 N adverse Y15 No change	Y1 S adverse Y15 Neutral
19	Welsh Road	Low	Y1 N beneficial Y15 N beneficial	Y1 S beneficial Y15 S beneficial
20	Claremont Avenue / Wales Coast Path	Moderate	Y1 Mo adverse Y15 Mi adverse	Y1 Mo adverse Y15 S adverse
21	Chemistry Lane / Factory Road	Low	Y1 N beneficial Y15 N beneficial	Y1 Neutral Y15 Neutral
22	Wales Coast Path	Moderate	Y1 Mo adverse Y15 Mi adverse	Y1 Mo adverse Y15 S adverse
23	Aston Quay landing stage	Moderate	Y1 Mi adverse Y15 N adverse	Y1 S adverse Y15 Neutral
24	Ferrybank Farm	Low	Y1 Mo adverse Y15 N adverse	Y1 S adverse Y15 Neutral
26	Willans and Robinson landing stage	Moderate	Y1 Mi adverse Y15 N adverse	Y1 S adverse Y15 Neutral
27	Foxes Lane	Low	Y1 Mi adverse Y15 N adverse	Y1 S adverse Y15 Neutral
29	Manor Road	Low	Y1 Mi adverse Y15 No change	Y1 S adverse Y15 Neutral

Visual receptors

9.7.9 Of the properties assessed, 31 existing dwellings are predicted to experience a significant adverse effect during the year of opening. With committed mitigation measures it is predicted that this would be reduced to no properties experiencing a significant adverse effect by design year.

9.7.10 In the table below Y = Year, N = Negligible, S = Slight, Mi = Minor, Mo = Moderate.

Table 9-18 Residential receptors (operation)

Ref	Location	Visual sensitivity	Magnitude of impact	Significance of effect
2SH	Ferrybank Farm [1 nr]	High	Y1 Mo adverse Y15 Mi adverse	Y1 Mo adverse Y15 S adverse
2SB	Sealand Manor farm and The Paddock [2 nr]	Moderate	Y1 Mi adverse Y15 No change	Y1 S adverse Y15 Neutral
2DU	Riverside Caravan Park [22 nr]	Moderate	Y1 Mo adverse Y15 Mi adverse	Y1 Mo adverse Y15 S adverse
2AA	Drybridge Farm [1 nr]	Moderate	Y1 Mi adverse Y15 Mi adverse	Y1 Neutral Y15 Neutral
2DD	Dundas Sidings [6 nr]	Moderate	Y1 N adverse Y15 N adverse	Y1 Neutral Y15 Neutral
2TA	Bridge Villas [4 nr]	Moderate	Y1 Mi adverse Y15 No change	Y1 S adverse Y15 Neutral
1TB.1	3 to 17 (odds) Queen Street [8 nr]	Moderate	Y1 No change Y15 No change	Y1 Neutral Y15 Neutral
1TB.2	21 to 41 (odds) Queen Street [11 nr]	Moderate	Y1 No change Y15 No change	Y1 Neutral Y15 Neutral
1TB.3	43 to 61 (odds) Queen Street [10 nr]	Moderate	Y1 No change Y15 No change	Y1 Neutral Y15 Neutral

Ref	Location	Visual sensitivity	Magnitude of impact	Significance of effect
1TB.4	38 to 58 (evens) Queen Street [11 nr]	Moderate	Y1 No change Y15 N beneficial	Y1 Neutral Y15 S beneficial
1SZ.1	17 to 45 (odds) Dundas Street [14 nr]	Moderate	Y1 No change Y15 No change	Y1 Neutral Y15 Neutral
1SZ.2	47 to 51 (odds) Dundas Street [3 nr]	Moderate	Y1 No change Y15 N beneficial	Y1 Neutral Y15 S beneficial
2SN.1	3 to 17 (odds) Claremont Avenue [8 nr]	Moderate	Y1 Mo adverse Y15 Mi adverse	Y1 Mo adverse Y15 S adverse
2SN.2	46 to 64 (evens) Claremont Avenue [10 nr]	Moderate	Y1 No change Y15 No change	Y1 Neutral Y15 Neutral
2SN.3	2 to 44 (evens) Claremont Avenue [22 nr]	Moderate	Y1 No change Y15 No change	Y1 Neutral Y15 Neutral
2SD	1 to 10 West Green [10 nr]	Moderate	Y1 No change Y15 No change	Y1 Neutral Y15 Neutral

9.8 Monitoring of Scheme Landscape Proposals

9.8.1 Landscape planting becomes established and trees and shrubs grow to form a mass such as a plantation or a hedgerow, scattered trees or visual screening belt. There are targets to be met by this form of mitigation, and monitoring is required for each:

a) Monitoring of plants to determine whether adequate establishment of trees is occurring. Percentage targets should be set so that the established plants are considered sufficiently dense to satisfy the performance requirements.

b) Monitoring of planting proposed as mitigation for significant visual impact, to assess whether the required height will be achieved by the Design Year to satisfy visual screening requirements.

9.8.2 Annual monitoring during the aftercare period will determine whether sufficient growth is being achieved each year by faster growing plants to satisfy screening objectives by the Design Year. This would involve some prediction of future growth rates based on those achieved in the aftercare period.

9.8.3 A monitoring visit by the Maintaining Agent at the end of the Design Year growing season to review mitigation and commence any ongoing management activity to thin, coppice ore underplant as required within the soft estate management plan.

9.8.4 The purpose of monitoring will be to identify and carry out any management interventions that are required to ensure mitigation satisfies the objectives.

9.9 Assessment of Cumulative Effects

9.9.1 The cumulative landscape and visual effects of the Scheme, in combination with known planning applications and allocated development sites, is contained within Chapter 17 (Assessment of Cumulative Effects and Inter-relationships).

Inter-relationships

9.9.2 The Landscape and Visual Impact Assessment process and the preparation of the Environmental Masterplan has been an iterative and collaborative process across the other environmental disciplines and the design team. This is reflected in this ES chapter which should be read in conjunction with the other ES chapters, in particular those relating to Terrestrial Biodiversity (Chapter 8), Cultural Heritage (Chapter 10), Noise and Vibration (Chapter 12), and Population and Human Health (Chapter 14).

9.10 Summary of Residual Effects

Landscape

9.10.1 The landscape assessment identified 52 landscape character areas, the boundaries of which have been established through a combination of desk study, review of

LANDMAP data and field visits. The LCAs capture the varying character of the study area which includes marshland reclaimed as agriculture, reclaimed marshland developed as industry and as settlements, gently undulating pastoral farmland, road and rail corridors and canalised river and flood plains. Of the 52 LCAs identified within he study area, 20 were filtered out as a consequence of the baseline assessment due to their negligible sensitivity to, and their physical and perceptual separation from the Scheme. The effects of the Scheme on each of the 32 remaining LCAs has been assessed for the construction stage (Section 9.6).

9.10.2 During construction, the Scheme would result in a moderate adverse significance of effect on LCA 50 (River Dee Canal – Saltney Ferry to Wepre Gutter). These effects are primarily a consequence of a temporary change of land use and reduction of tranquillity. Of the 32 LCAs assessed, 22 were judged to experience a neutral significance of effect during construction and were filtered out from further assessment. The effects of the Scheme on each of the 10 remaining LCAs has been assessed for the operation phase (Section 9.7).

9.10.3 During year of opening, the significance of effect associated with the replacement bridge would remain as moderate adverse for LCA 50. The lack of change in the significance of effect when compared to the construction stage would be as a consequence of the influence of the road corridor on the canalised river and the degradation of vegetation over a medium-term duration.

9.10.4 By design year, the significance of effect would reduce to slight adverse for LCA 50. This would be as a consequence of the restoration of land use to its original purpose, re-establishment of vegetation that would create a visual barrier between the river corridor and the road corridor.

Visual

9.10.5 The number of visual receptors from which views would be significantly adversely affected by the Scheme would be at its greatest during the construction phase (Section 9.6). Construction of the replacement bridge and removal of the existing bridge would be substantial and highly noticeable elements. 3 representative viewpoints would experience a large adverse significance of visual effect. The

receptors are in close proximity to the proposal and have limited foreground elements intervening in the view. 4 representative viewpoints and 7 residential groups (57 dwellings) would experience a moderate adverse significance of visual effect. The receptors are close to the proposal and would see substantial change in visual amenity during construction.

9.10.6 During year of opening (Section 9.7), 2 representative viewpoints, both located on the Wales Coast Path upriver and downriver of the existing and replacement bridge are predicted to experience a moderate adverse significance of visual effect. The receptors are in close proximity and have no foreground elements intervening in the view. 3 residential groups (31 dwellings), would experience a moderate negative significance of visual effect.

9.10.7 By design year, it is expected that no representative viewpoints and no residential groups would experience a significant negative visual effect. Committed mitigation measures would reduce the significance of visual effect on the 7 representative viewpoints and 7 residential groups.

Llywodraeth Cymru / Welsh Government

A494 RIVER DEE BRIDGE REPLACEMENT SCHEME

Environmental Statement

Volume 1: Technical Assessment Report

Chapter 10: Archaeology and Cultural Heritage

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10. Archaeology and Cultural Heritage

10.1 This document

10.1.1 This chapter considers the direct and indirect impact of the Scheme on cultural heritage, including buried archaeological sites, historical buildings and historical landscapes. It identifies the likely impacts on these 'historic assets' in terms of the potential for direct physical disturbance and changes within the settings of the assets and assesses the overall significance of effect.

10.1.2 The following stages of the Scheme are likely to affect features of cultural heritage:

10.1.3 **Construction (including land take)**: this is the phase where direct, physical impacts on built historic assets and buried archaeological remains are most likely to occur. In addition, in some cases construction activity may result in an effect on setting.

10.1.4 **Operation**: this is the phase during which nearby historic assets may experience impacts due to visual and acoustic changes within their settings, and there would also be changes to the character of the historic landscape.

10.1.5 Within the 500 m study area on either side of the Scheme boundary, 82 assets were identified. Of these, 12 assets are potentially physically impacted. The remaining 70 assets are outside the Scheme and should not be impacted. The Study Area is explained in paragraphs 10.3.16 and 10.3.17.

10.2 Legislation and Policy Framework

Relevant Legislation

10.2.1 The primary legislation applicable to this chapter is the Historic Environment (Wales) Act 2023, which came into effect in November 2024. The previous legislative framework for the management and protection of the Welsh historic environment, principally the Ancient Monuments and Archaeological Areas Act 1979 and the Planning (Listed Buildings and Conservation Areas) Act 1990, no longer apply in Wales. The new legislation will make it easier for everyone to find,

understand and apply the law, but it will make no changes to the current management and protection of the Welsh historic environment.

10.2.2 In response to this additional primary legislation, planning policy was reviewed and guidance updated.

National Planning Policy

10.2.3 The relevant national planning policy is Planning Policy Wales (Welsh Government, 2024) (PPW). Section 6.1 of PPW (Conserving the Historic Environment) establishes the Welsh Government objectives regarding the protection of the historic environment. It further explains that local planning authorities have an important role in this protection, whilst ensuring that the historic environment can accommodate and respond to the current needs of society.

10.2.4 PPW identifies Cadw as the historic environment division of the Welsh Government and 'has responsibility for protecting, conserving and promoting an appreciation of the historic environment of Wales's (paragraph 6.2.1). It lays out the duties of Welsh Government regarding the compilation of lists of buildings of special architectural or historic interest (i.e. listed buildings) and the scheduling of ancient monuments that are considered to be of national importance (i.e. scheduled monuments).

10.2.5 The roles of the Royal Commission on the Ancient and Historical Monuments of Wales (RCAHMW) and Heneb: the Trust for Welsh Archaeology (formerly the four Welsh Archaeological Trusts) are also defined. PPW goes on to provide advice with regard to the management of designated and non-designated heritage assets.

10.2.6 With regard to archaeological remains, Section 6 of PPW states that '*The planning system recognises the need to conserve archaeological remains. The conservation of archaeological remains and their settings is a material consideration in determining planning applications, whether those remains are a scheduled monument or not.'* (paragraph 6.1.23).

10.2.7 The policy regarding listed buildings is presented in Section 6.1.10 of PPW: '*There should be a general presumption in favour of the preservation or enhancement of a listed building and its setting, which might extend beyond its curtilage. For any development proposal affecting a listed building or its setting, the primary material consideration is the building, its setting, or any features of special architectural or historic interest which it possesses*' (paragraph 6.1.10). The latter statement refers to the requirements under Section 66(1) of the Planning (Listed Buildings and Conservation Areas Act) 1990.

Local Planning Policy

10.2.8 The Flintshire Local Development Plan, adopted January 2024, contains the following proposed policies relevant to the historic environment and cultural heritage:

Policy EN8	Built Historic Environment and Listed Buildings
STR13	Natural and Built Environment, Green Networks and Infrastructure

10.3 Assessment Methodology

Relevant Guidance

Technical Advice Note (TAN) 24: The Historic Environment

10.3.1 (TAN 24 Welsh Government, 2017) forms a single document giving guidance for the planning system as it considers the historic environment during development plan preparation and decision making planning and listed building applications.

10.3.2 The historic environment is defined as: '*All aspects of the environment resulting from the interaction between people and places through time, including all surviving physical remains of past activity, whether visible, buried or submerged, and deliberately planted or managed.' A historic asset is: 'An identifiable component of the historic environment. It may consist or be a combination of archaeological site, a historic building or area, historic park and garden or a parcel*

of historic landscape. Nationally important historic assets will normally be designated.

10.3.3 Taken together, and set within their cultural context, historic assets contribute to the character and sense of place of different parts of Wales (TAN 24 1.7).

10.3.4 TAN 24 uses the *Conservation Principles for the Sustainable Management of the Historic Environment in Wales* (Conservation Principles), published in 2011 as a basis upon which Cadw discharges its statutory duties. Conservation Principles should be used to assess the potential impacts of a development proposal on the significance of any historic asset/assets and to assist in decision-making where the historic environment is affected by the planning process (TAN 24 1.10).

10.3.5 Six principles are used:

a) Historic assets would be managed to sustain their values;

b) Understanding the significance of historic assets is vital;

c) The historic environment is a shared resource;

d) Everyone will be able to participate in sustaining the historic environment;

e) Decisions about change must be reasonable, transparent and consistent;

f) Documenting and learning from decisions is essential.

10.3.6 TAN 24 shows that heritage impact assessment is a structured process to enable the significance of a designated asset to be considered when considering proposals for change.

10.3.7 Information on historic assets in Wales is included in TAN 24. This describes the sources of information on designated historic assets (scheduled monuments, listed buildings and protected wrecks) and areas on the register of historic parks and gardens and the register of historic landscape in Wales. The large majority of historic assets are not designated and the largest comprehensive set of data on all known archaeological sites, historic buildings and other components of historic landscape is found in the Historic Environment Records (HERs), maintained by Heneb: The Trust for Welsh Archaeology.

10.3.8 TAN 24 describes the importance of archaeological sites and their fragility and vulnerability to damage. The development management process maintains a presumption that preservation in-situ is the preferred option for the management of assets that may be affected by development. TAN 24 outlines the procedures to be followed for the preservation, or were considered appropriate, the excavation and recording of archaeological features. This includes defining the scope of work and monitoring performance. The need to provide a contingency to deal with unexpected archaeological discoveries by the developer is also emphasised.

Setting of Historic Assets in Wales

10.3.9 Cadw (2017) gives guidance on the measures to assess the potential visual impact of developments. The introduction to this makes it clear that all individual historic assets, irrespective of their designation, are affected by this guidance.

10.3.10 Section 4 of Setting Historic Assets in Wales lays out the stages of assessment that are to be followed:

Stage 1 Identify the historic assets that might be affected by a proposed change or development.

Stage 2: Define and analyse the settings to understand how they contribute to the significance of the historic assets and, in particular, the ways in which the assets are understood, appreciated and experienced.

Stage 3: Evaluate the potential impact of a proposed change or development on that significance.

Stage 4: If necessary, consider options to mitigate or improve the potential impact of a proposed change or development on that significance.

10.3.11 The document identifies the criteria for the setting of a scheduled monument on which Cadw must be consulted for a planning application. This Scheme meets the following criteria:

a) Development likely to be visible from a scheduled monument and which meets one of the following criteria:

b) it is within a distance of 5 kilometres from the perimeter of a scheduled monument and is 100 metres or more in height or has an area of 1 hectare or more."

10.3.12 Therefore, this study considers all designated assets within 5 km of the project boundary.

Design Manual for Roads and Bridges (DMRB)

10.3.13 The overall assessment of impacts and effects presented in this chapter is in line with DMRB LA104 Environmental Assessment, Revision 1, August 2020 (Highways Agency, 2019a). This provides guidance on the assessment and management of environmental effects, including advice on determining the magnitude of impacts and the significance of effects.

10.3.14 DMRB guidance specific to the historic environment and cultural heritage is provided in the DMRB LA106 Cultural Heritage Assessment, Revision 1, January 2020 (Highways Agency, 2019b). This splits the cultural heritage resource into three separate but related sub-topics: Archaeological Remains; Historic Buildings and Historic Landscape.

Chartered Institute for Archaeologists' Standard and Guidance

10.3.15 In addition to the above, the following documents were utilised within the programme of baseline data gathering:

a) Standard and guidance for historic environment desk-based assessment (Chartered Institute for Archaeologists, 2020);

b) Standard and guidance for the creation, compilation, transfer and deposition of archaeological archives (Chartered Institute for Archaeologists, 2020);

c) Heneb: the Trust for Welsh Archaeology published guidance on the Submission of Data to the Welsh Historic Environment Records (HERs) December 2024.

Sources of information

a) National Library for Wales, Aberystwyth for maps and documents

b) Flintshire County Archives, Hawarden

c) Welsh Government Aerial Archive[1]

d) Portable Antiquities Scheme database[2]

e) Conservation Area details: Flintshire County Council Conservation Officer

f) Designated asset data from Cadw[3]

g) Archaeological records held by the National Monuments record RCAHMW including information on historic place names[4].

h) Archaeological records held by Heneb (the Clwyd Powys Archaeology HER) (via direct consultation with the HER team[5].

i) Historic England database for registered assets in the 5 km study area located in Cheshire West and Chester.

Study Area

Designated assets

10.3.16 Designated assets are those that are given statutory protection. This status can include World Heritage Sites, Ancient Monuments and Listed Buildings. To identify Designated historic assets that could have significant change in their settings, the study area has included all such assets within a zone of 5 km. The locations of Designated Sites are shown in Figure 10.1.

[1] https://datamap.gov.wales/maps/apu-welsh-government-aerial-photography/view#/
[2] https://finds.org.uk/
[3] http://historicwales.gov.uk
[4] https://rcahmw.gov.uk/discover/list-of-historic-place-names/
[5] her@heneb.org.uk

Non-designated assets

10.3.17 Non-designated assets are those sites which are not given statutory protection. The study area for historic asset collection was a corridor 500 m beyond the boundary of the proposed Scheme and the land take. Where linear or historic landscape features extend beyond the 500 m area, the study area was extended in order to provide sufficient context for the understanding of such features.

Approach to Identification of Baseline Conditions

10.3.18 Full coverage of the regional HER for the main study area was acquired from the Clwyd Powys HER of Heneb: The Trust for Welsh Archaeology, together with details of defined Historic Landscape Character Areas. Information regarding scheduled monuments, listed buildings and Registered Parks, Gardens and Landscapes of Special Historic Interest was obtained from Cadw and published sources. Data was collected in 2024 and early 2025.

10.3.19 Site visits were conducted in September and November 2024.

10.3.20 Available satellite imagery covering the Scheme was acquired from commercial suppliers and examined along with other historic aerial photographs. LiDAR data obtained from the Welsh Government 1m DSM hillshade model was used to obtain detailed information on the location of sites. The LiDAR was also used to provide information on the intervisibility and setting of sites.

Assessment Criteria and Assignment of Significance

10.3.21 The assessment of impacts and effects on cultural heritage receptors was undertaken in accordance with the methodology described in DMRB LA106 Cultural Heritage Assessment, Revision 1 (Highways Agency, 2019b). The overall approach to the assessment of the significance of effects is in line with DMRB LA104 Environmental Assessment (Highways Agency, 2019a). This provides guidance on the assessment and management of environmental effects, including advice on determining the magnitude of impacts and the significance of effects.

10.3.22 DMRB LA106 considers the cultural heritage resource as three separate but related sub- topics: Archaeological Remains; Historic Buildings and Historic Landscape. For each sub-topic, guidance is provided with regard to the assessment of value (of the resource) and also impact types and impact magnitude. An overall significance of effect on each identified receptor is reached by combining value and impact magnitude within a single matrix. The results for each sub-topic are then brought together to provide an overview of the significance of the effect of the Scheme on the combined cultural heritage resource.

Receptor Value

10.3.23 In order to reach an understanding of the level of any effect that a scheme may have on a historic asset; it is necessary to understand the importance of that asset. For example, is it important at a national level or at a local level?

10.3.24 DMRB LA106 Cultural Heritage Assessment Table 3.2N and Cadw guidance (Understanding Listing in Wales, Cadw, 2018) is used to create Tables 10.1 and 10.2 for assessing the value (significance) of historic assets.

Table 10-1 Factors for Assessing the Value of Archaeological Assets

Value (sensitivity)	Factors
Very High	World Heritage Sites (including nominated sites). Assets of acknowledged international importance. Assets that can contribute significantly to acknowledged international research objectives.
High	Scheduled Ancient Monuments (including proposed sites). Non-designated assets of schedulable quality and importance. Assets that can contribute significantly to acknowledged national research objectives.
Medium	Designated or non-designated assets that contribute to regional research objectives.
Low	Designated and non-designated assets of local importance. Assets compromised by poor preservation and/or poor survival of contextual associations. Assets of limited value, but with potential to contribute to local research objectives.
Negligible	Assets with very little or no surviving archaeological interest.
Unknown	The importance of the resource has not been ascertained.

Table 10-2 Criteria for Establishing Value of Historic Buildings

Value (sensitivity)	Criteria
Very High	Structures inscribed as of universal importance as World Heritage Sites. Other buildings of recognised international importance.
High	Scheduled Ancient Monuments with standing remains. Listed Buildings, Other listed buildings that can be shown to have exceptional qualities in their fabric or historical associations not adequately reflected in the listing grade. Conservation Areas containing very important buildings. Non-designated structures of clear national importance. Registered Parks and Gardens, Registered Historic Landscapes.
Medium	Historic (unlisted) buildings that can be shown to have exceptional qualities in their fabric or historical associations. Conservation Areas containing buildings that contribute significantly to its historic character. Historic Townscape or built-up areas with historic integrity in their buildings or built settings (e.g. including street furniture and other structures).
Low	'Locally Listed' buildings.

Value (sensitivity)	Criteria
	Historic (unlisted) buildings of modest quality in their fabric or historical association. Historic Townscape or built-up areas of limited historic integrity in their buildings or built settings (e.g. including street furniture and other structures).
Negligible	Buildings of no architectural or historic note; buildings of an intrusive character.
Unknown	Buildings with some hidden (i.e. inaccessible) potential for historic significance.

Magnitude of Impact

10.3.25 The magnitude of an impact is assessed without regard to the value of the historic asset. In terms of the judgement of the magnitude of impact, this is based on the principle that preservation of the asset is preferred, and that total physical loss of the asset is least preferred.

10.3.26 With regard to buried archaeological remains, it is not always possible to assess the physical impact in terms of percentage loss, and therefore it can be important in such cases to try to assess the capacity of the historic asset to retain its character and significance following any impact.

10.3.27 DMRB LA106 Cultural Heritage Assessment provides Table 3.2N which has been used to formulate Tables 10.3 and 10.4 showing factors to be used for archaeological remains, historic buildings, Registered Parks and Gardens and Historic landscapes, in the assessment of magnitude of impact.

Table 10-3 Factors in the Assessment of Magnitude of Impact on Archaeological Remains

Impact magnitude	Factors
Major	Change to most or all key archaeological materials, such that the resource is totally altered. Comprehensive changes to setting.
Moderate	Changes to many key archaeological materials, such that the resource is clearly modified. Considerable changes to setting that affect the character of the asset.

Impact magnitude	Factors
Minor	Changes to key archaeological materials, such that the asset is slightly altered. Slight changes to setting.
Negligible	Very minor changes to archaeological materials or setting.
No change	No change.

Table 10-4 Factors in the Assessment of the Magnitude of Impact – Historic Buildings

Impact magnitude	Factors
Major	Change to key historic building elements, such that the resource is totally altered. Comprehensive changes to setting.
Moderate	Changes to many key historic building elements, such that the resource is significantly modified. Changes to the setting of an historic building, such that it is significantly modified.
Minor	Change to key historic building elements, such that the asset is slightly different. Change to setting of an historic building, such that it is noticeably changed.
Negligible	Slight changes to historic building elements or setting that hardly affect it.
No change	No change to fabric or setting.

Settings

10.3.28 DMRB LA106 Cultural Heritage Assessment refers to effects on the settings of historic assets and explains that setting is a material consideration in government policy relating to the cultural heritage and the historic environment.

10.3.29 The existence of direct lines of sight between an historic asset and a scheme is an important factor in judging the visual impact of the development. However, it is possible for changes within the setting to occur even when such a relationship does not exist. For example, views towards a listed building from a frequently visited location, such as a park or a public footpath, may be affected by the presence of a larger development, even if the development is not directly visible from the building itself.

10.3.30 Consideration has also been given to the sensitivity to change of the setting of a historic asset. This is done through examination of the current setting with regard to identifying elements that contribute to the significance of the asset, elements that make a neutral contribution to the significance of the asset and elements that make a negative contribution (i.e. detract from) the significance of the asset.

10.3.31 Once the impact on the value of the historic asset was examined, this was then related to the magnitude of impact scales defined below. These are closely linked to the magnitude of impact scales used in DMRB LA106 Cultural Heritage Assessment.

Table 10-5 Factors in the Assessment of Magnitude of Impact on settings

Magnitude	Scale of Impact
Major:	Substantial change within the setting leading to considerable loss or enhancement of significance of the asset.
Moderate:	Change within the setting leading to some loss or enhancement of significance of the asset.
Minor:	Slight change within the setting leading to a slight loss or enhancement of significance of the asset.
Negligible:	Very minor changes within the setting that hardly affect the significance of the asset.
No change:	No substantive change within the setting.

Significance of Effect

10.3.32 The level or significance of an effect is a combination of the value of the historic asset and the magnitude of impact on that asset. Effects can be adverse or beneficial. Beneficial effects are those that mitigate existing impacts and help to restore or enhance historic assets, therefore allowing for greater understanding and appreciation.

10.3.33 DMRB LA106 Cultural Heritage Assessment refers to an assessment matrix shown in Table 3.8.1in LA104. This is shown in Table 10.7 in this chapter and is intended for use within all three sub-topics. The matrix is not intended to 'mechanise' the process of assessment of the significance of the effect but rather

to act as a check that can ensure judgements of value, impact magnitude and significance of effect are balanced. Where the matrix produces a level of effect significance that is clearly unreasonable, the judgements of value and impact magnitude should be reassessed to ensure that they can be justified.

Table 10-6 DMRB Descriptors of Significance of Effect Categories

Significance category	Typical Descriptors of Effect
Very large	Only adverse effects are normally assigned this level of significance. They represent key factors in the decision-making process. These effects are generally, but not exclusively, associated with sites or features of international, national or regional importance that are likely to suffer a most damaging impact and loss of resource integrity. However, a major change in a site or feature of local value may also enter this category.
Large	These beneficial or adverse effects are considered to be very important considerations and are likely to be material in the decision- making process.
Moderate	These beneficial or adverse effects may be important but are not likely to be key decision-making factors. The cumulative effects of such factors may influence decision-making if they lead to an increase in the overall adverse effect on a particular resource or receptor.
Slight	These beneficial or adverse effects may be raised as local factors. They are unlikely to be critical in the decision-making process but are important in enhancing the subsequent design of the project.
Neutral	No effects or those that are beneath levels of perception, within normal bounds of variation or within the margin of forecasting error.

Table 10-7 Significance Matrix

		Magnitude of impact				
		No change	Negligible	Minor	Moderate	Major
Value (Sensitivity)	Very High	Neutral	Slight	Moderate or Large	Large or Very Large	Very Large
	High	Neutral	Slight	Slight or Moderate	Moderate or Large	Large or Very Large
	Medium	Neutral	Neutral or Slight	Slight	Moderate	Moderate or Large
	Low	Neutral	Neutral or Slight	Neutral or Slight	Slight	Slight
	Negligible	Neutral	Neutral	Neutral or Slight	Neutral or Slight	Slight

Consultations

10.3.34 Cadw advises the Welsh Government and is the statutory consultee on designated monuments. They appointed Heneb: The Trust for Welsh Archaeology as the primary consultee to the Local Planning Authority for heritage matters. Heneb are also responsible for maintaining the Historic Environment Records (HERs). Flintshire County Council Built Conservation Officer can advise on Listed Buildings and Conservation Areas.

10.3.35 Heneb were represented at Environmental Liaison Meetings during development phases of the scheme over the last few years and have been able to comment on proposals, including submission of a Written Scheme of Investigation and a draft of this assessment. Their comments have been taken into consideration

Limitations of the Assessment

10.3.36 All readily available data required for the assessment were acquired and examined. A key limitation is knowledge of the presence or absence of buried archaeological remains within the Scheme boundary. Various techniques and

data sources were used to remotely gain as much information of potential information at this stage.

10.3.37 There has been no intrusive archaeological investigation within the Scheme boundary. Knowledge of buried archaeological remains and areas within the Scheme boundary considered to be of higher potential for archaeological remains, is based on the output from ground and aerial-based remote sensing.

10.3.38 Some of the data appears to be slightly at variance between what is available in the regional HER and features as observed on the ground. This relates to the accuracy of national grid references as derived from historical mapping and is both a transcription error and result of large changes in the landscape making map rectification difficult.

10.3.39 The information gathered to date is considered to provide sufficient information to form the basis of the assessment for EIA purposes.

10.4 Baseline Conditions

10.4.1 A Desk Based Assessment (DBA) report has been prepared to examine the proposed bridge replacement scheme. The study includes all the information known for non-designated sites in an area within 500 m on either side of the Scheme boundary. Information on designated sites was collected for a zone 5 km wide on either side of the Scheme boundary.

10.4.2 The Scheme lies within the parish of Hawarden, to the east of the town of Queensferry, Flintshire. Within the 500 m study area on either side of the Scheme boundary, 82 assets were identified. Of these, 13 assets are potentially physically impacted. The remaining 69 assets are outside the Scheme and should not be impacted.

10.4.3 The known archaeological evidence, with a brief historical baseline for the wider zone around the Scheme, is presented below. Details of sites identified in the 500 m study area are included, identified by a reference number in brackets, e.g. (Site 63).

10.4.4 The historic assets of cultural heritage origins in the study area are varied. The majority of sites are from the last two hundred years, but a range of sites known in the area stretch back through the medieval to the Roman period. The historical assets in the 500 m study area are shown within Figure 10.2 and Appendix 10.A.

Prehistoric (to AD 43)

10.4.5 There is little known regarding the earlier prehistoric periods within the Study Area because no prehistoric remains are recorded. Outside the Study Area, recorded examples of Mesolithic material have been found on the Dee estuary at Rhyl and Rhuddlan to the north of the area as well as on the northern coast of the Wirral. Paleoenvironmental data suggests that the Dee estuary was a deep river valley before the rise in sea levels in the early post-glacial period. This area would have been attractive habitat for exploitation of seasonal resources. The area was inhabited during the Iron Age by the Deceangli tribe, and later by the Romans. There are no sites of the prehistoric period known in the 500 m Study Area.

Roman (AD 43 to AD 410)

10.4.6 Roman remains are limited to the settlement at Pentre Bridge now ‘Pentre Ffwrndan’, Flint, 7 kilometres west of the Study Area. Excavation at this site, revealed high status buildings, lead working industry remains and extensive settlement evidence as well as a cemetery. The function of the site appears to be associated with lead mining on Halkyn Mountain. A Roman port is presumed to be present at Flint although this has not been located. There was a large Roman presence at Chester and several roads extended from there, including those passing through Flintshire and along the north Wales coast. There are no sites of the Roman period known in the 500 m Study Area.

Early Medieval (410 to 1066)

10.4.7 Aside from the presence of Offa’s Dyke to the west of Northop and Ewloe, evidence of early medieval activity is scarce. Certain ecclesiastical sites are purported to originate in this period, although physical evidence is lacking. Place name analysis of settlements and historic map regression of early church

boundaries suggests that some areas such as Hawarden originated in this period. No sites of the early medieval period known in the 500 m Study Area.

Medieval (1066 to 1500)

10.4.8 Several of the towns in the wider area are documented during this period. Flint itself dates to the mid-13th century and originally acted as a campaign base for Edward I and as a result, had extensive defensive arrangements. The towns of Northop and Hawarden all appeared during the medieval period; while Ewloe and Hawarden both have castles dating to this period. The area saw much unrest and conflict as it is located in the borderlands between Wales and England. Wepre Woods, close to Ewloe Castle, was the scene of a battle where the Welsh forces of Owain Gwynedd and the invading forces of Henry II clashed in 1157. No sites of the medieval period are known in the 500 m Study Area.

Post-medieval (1500 to 1900)

10.4.9 The area saw a rapid expansion during the post-medieval period. Expansion during this period was linked primarily to the coal and lead mining industries (Sites 12, 13, 17, 19) which led to a movement of people into the area. A wide variety of denominations are represented by the churches and chapels in the study area. Many surviving structures illustrate this multitude of ecclesiastical sites (Sites 14, 15, 16, 22, 34, 35, 36, 39). Further examples of the built heritage show the types of industrial processes occurring within this part of the Dee Estuary. Iron and steel works, textile mills and alkali works are all present in the study area, although these generally date to the latest part of the period (Sites 40, 44, 46,47, 52, 56, 58, 61, 62, 65, 66, 67, 68, 70, 74, 75). Several transport-related sites are present, mainly connected to the railway, which allowed the movement of raw materials and finished goods (Sites 20, 21, 23). The main development in the landscape was the canalisation of the River Dee. The new canal portion opened for river traffic in 1737, and this allowed large areas of former marshland to be reclaimed in the Shotton and Queensferry areas. A particular development of this was the transport of coal by sea feed by tramways (Sites 11, 30, 49, 63) from the coal mines to quays along the south bank of the River Dee (Sites 27, 28, 40, 42, 50,

51, 53, 55, 57, 67). An associated industry was the Aston port that included shipbuilding (Sites 29, 32, 37, 43, 48)

Modern (1900 to present)

10.4.10 Sites dating from the modern period generally comprise examples of built heritage and infrastructure constructed in the early 20th century. These include a number of chapels, commercial buildings and workers' housing, such as Sealand New town (Sites 1, 5, 18, 60, 77, 80, 81, 82, 83). There are several military and associated locations in this area of Flintshire. The major site is the airfield of RAF Sealand with extant World War I and World War II built heritage. This also include defensive works of World War II, mostly pillboxes along the River Dee and surrounding RAF Sealand (Sites 26, 73, 78, 79). The sites also include buildings used as prisoner-of-war camps, plane crash sites and memorials (Sites 8, 9, 25, 59). Of relevance to the project is the construction of bridges across the Dee. The original Queen's Ferry (Site 41) was replaced by the Victoria Jubilee Bridge in 1899 (Site 33). This was a retracting drawbridge to allow vessels to pass. Soon it became too small for the traffic, so was replaced by the double bascule bridge in 1924 (Site 31). The buttresses of the original bridge can be seen on either side of the river downstream from the bascule bridge. The modern bridge carrying the A494 was built in 1960-1962.

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Table 10-8 Gazetteer of historical assets (designated and un-designated) within 500 m of the Scheme, showing the assessment of impact and setting

No.	Name and designation	Significance Value	Magnitude of Impact	Significance of effect (physical)	Significance of effect (setting)
1	Clay Hills; house	Negligible	No Change	Neutral	Neutral
2	Clay Hills Well II	Negligible	No Change	Neutral	Neutral
3	The Hom Open Field system	Low	No Change	Neutral	Neutral
4	Queensferry Stone I	Low	No Change	Neutral	Neutral
5	Unwins Cottage; house	Negligible	No Change	Neutral	Neutral
6	Clay Hills Well I	Negligible	No Change	Neutral	Neutral
7	Queensferry Stone II	Low	No Change	Neutral	Neutral
8	Queensferry War Memorial Institute (LBII Cadw 84434)	High	No Change	Neutral	Negligible
9	Prisoner of War Camp	Low	No Change	Neutral	Neutral
10	Queensferry Stone III	Low	No Change	Neutral	Neutral
11	Aston Hall Colliery Railway	Negligible	Negligible	Slight	Neutral
12	Hawarden Old Clay Pits	Negligible	No Change	Neutral	Neutral
13	Aston Hall Colliery	Negligible	No Change	Neutral	Neutral
14	Church	Medium	No Change	Neutral	Neutral
15	Trinity English Wesleyan Methodist Chapel	Medium	No Change	Neutral	Neutral
16	Queensferry Primitive Methodist Chapel	Medium	No Change	Neutral	Neutral
17	Queensferry Colliery	Negligible	No Change	Neutral	Neutral
18	Queensferry Hall Garden	Medium	No Change	Neutral	Neutral
19	Coal Pit Field coal mine	Negligible	No Change	Neutral	Neutral
20	Queensferry Railway Station	Medium	No Change	Neutral	Neutral

No.	Name and designation	Significance Value	Magnitude of Impact	Significance of effect (physical)	Significance of effect (setting)
21	Queensferry railway station	Medium	No Change	Neutral	Neutral
22	Bethel Welsh Calvinistic Methodist Chapel	Medium	No Change	Neutral	Neutral
23	Queensferry railway	Low	No Change	Neutral	Neutral
24	Queensferry Smithy	Negligible	No Change	Neutral	Neutral
25	Airspeed Oxford II N4731; air crash site	Unknown	No Change	Neutral	Neutral
26	Pillbox	Low	No Change	Neutral	Neutral
27	Queensferry Landing Stage	Medium	No Change	Neutral	No Change
28	Queensferry Quay	Medium	No Change	Neutral	Neutral
29	Queensferry Shipyard I	Low	No Change	Neutral	Neutral
30	Aston Colliery Tramway	Negligible	No Change	Neutral	Neutral
31	Bascule Bridge (LBII Cadw 84433 and 85251)	High	No Change	Neutral	Slight
32	Queensferry Jetty slipway	Medium	No Change	Neutral	Neutral
33	Victoria Jubilee Bridge	Low	No Change	Neutral	Neutral
34	Mission Hall	Medium	No Change	Neutral	Neutral
35	Holy Innocents Church	Medium	No Change	Neutral	Neutral
36	St Andrew's Church	Medium	No Change	Neutral	Neutral
37	Aston Quay Weighbridge	Negligible	Negligible	Neutral	Neutral
38	Ferry Inn	Negligible	No Change	Neutral	Neutral
39	Chapel	Medium	No Change	Neutral	Neutral
40	Aston Quay Landing Stage I	Medium	No Change	Neutral	Neutral
41	Lower Kings Ferry crossing	Low	No Change	Neutral	Neutral
42	Queensferry Landing Stage II	Medium	No Change	Neutral	Neutral

No.	Name and designation	Significance Value	Magnitude of Impact	Significance of effect (physical)	Significance of effect (setting)
43	Aston Quay Building	Medium	Negligible	Neutral	Neutral
44	Queensferry Chemistry Factory	Negligible	No Change	Neutral	Neutral
45	Queensferry Chapel	Negligible	Negligible	Slight	Neutral
46	Queensferry Shipyard II	Low	Negligible	Slight	Neutral
47	Queensferry Chemical Works Railway	Negligible	Negligible	Slight	Neutral
48	Aston Quay; port	Medium	Major	Moderate	Neutral
49	Aston Railway	Low	Negligible	Neutral	Neutral
50	Aston Quay Landing Stage IV	Medium	Major	Moderate	Neutral
51	Aston Quay Landing Stage III	Medium	Major	Moderate	Neutral
52	Queensferry Chemical Works	Low	No Change	Neutral	Neutral
53	Aston Quay Landing Stage V	Medium	Major	Moderate	Neutral
54	Garden City Congregational Chapel	Medium	No Change	Neutral	Neutral
55	Aston Quay Landing Stage VI	Medium	No Change	Neutral	Neutral
56	Queensferry Wireworks Factory	Low	No Change	Neutral	Neutral
57	Aston Quay Landing Stage VII	Medium	No Change	Neutral	Neutral
58	Queensferry Munitions Factory	Negligible	No Change	Neutral	Neutral
59	Queensferry Prisoner of War Camp	Low	No Change	Neutral	Neutral
60	Garden City School	Medium	No Change	Neutral	Neutral
61	Former Willans & Robinson Factory West Block (LBII Cadw 85240)	High	No Change	Neutral	Slight
62	Queensferry Willans & Robinson Factory Railway	Negligible	No Change	Neutral	Neutral
63	Mancot Colliery Tramway	Negligible	No Change	Neutral	Neutral

No.	Name and designation	Significance Value	Magnitude of Impact	Significance of effect (physical)	Significance of effect (setting)
64	Mancot Tramway Pier	Low	No Change	Neutral	Neutral
65	Former Willans & Robinson Factory Central Block (LBII Cadw 85241)	High	No Change	Neutral	Slight
66	Former Willans & Robinson Factory East Block (LBII Cadw 85242)	High	No Change	Neutral	Slight
67	Queensferry Willans & Robinson Factory Reservoir	Low	No Change	Neutral	Neutral
68	Queensferry Willans & Robinson Factory Aerial Ropeway	Negligible	No Change	Neutral	Neutral
69	Ferry Bank Farm (LBII Cadw 85249)	High	No Change	Neutral	Slight
70	Queensferry Willans & Robinson Factory Landing Stage I	Medium	No Change	Neutral	Neutral
71	Dee Boundary Stone	Low	No Change	Neutral	Neutral
72	Sealand Manor Farm Watering Place	Low	No Change	Neutral	Neutral
73	Pillbox, Blue Bridge	Negligible	No Change	Neutral	Neutral
74	Storage tank	Negligible	No Change	Neutral	Neutral
75	Sluice	Negligible	Major	Slight	Neutral
76	United Reformed Church	Low	No Change	Neutral	Neutral
77	Sealand Garden City	Low	No Change	Neutral	Neutral
78	Pillbox, Sandycroft	Low	No Change	Neutral	Neutral
79	Pillbox	Low	No Change	Neutral	Neutral
80	Hawarden Castle Hotel	Low	No Change	Neutral	Neutral
81	Hawarden Castle Hotel Outbuilding I	Low	No Change	Neutral	Neutral
82	Hawarden Castle Hotel Outbuilding II	Low	No Change	Neutral	Neutral

10.5 Assessment of Potential Construction Effects

10.5.1 The potential direct physical land take impacts on historic assets that would occur at the start of the construction phase, along with the consequent effects, are described in this section.

10.5.2 The potential direct non-physical impacts of the new component of the Scheme on historic assets (i.e. impacts on the settings of such assets), along with the consequent effects, are generally considered to correspond with those described in paragraph 10.5.42 which addresses temporary and permanent operational effects.

Description of Environmental Effects

10.5.3 Assets located within 500 m of the Scheme are listed in Table 10-8 and the locations shown in Figure 10.2. Reference numbers on the table refer to the sites on the figures. Table 10-8 lists the type of asset, their significance, the magnitude of any impact and the significance of the effect. The table also includes an assessment of the impact of the Scheme on the setting of each of the assets. The descriptions first examine those sites where a physical impact is seen, which is typically permanent. It then examines those sites that have a temporary, construction related impact, together with locations where a permanent effect is experienced during the Operation of the Scheme.

Physical impact

10.5.4 In the 500 m buffer zone on either side of the Scheme boundaries, identified as the study area, 82 sites were identified. Seventy (70) sites would not be physically affected by the Scheme. Five (5) sites will have a major permanent impact, and seven (7) sites a permanent effect assessed as being negligible. These are described below in paragraphs 10.5.5-39.

Site 11 Aston Hall Colliery Railway

10.5.5 HER PRN 37790 also including HER PRN 99063. Aston Hall Colliery Railway, shown on Ordnance Survey 1st edition 25" 1871. This ran from the Aston Hall

Colliery down to the Aston Quay landing stage for loading onto ships. The present A494 road followed the line of the railway when it was built in 1961. The route of the railway lies under the existing A494 road which will have removed nearly all deposits.

10.5.6 The significance of the feature is assessed as being Negligible, with a physical impact. The significance of effects is assessed as being Slight.

Site 37 Aston Quay weighing machine

10.5.7 HER PRN 83027. Aston Quay weighing machine depicted on OS 1st ed 25" 1870 on northwest side of the Aston Railway as it entered the quayside.

10.5.8 No evidence for the feature can be seen as it lies under the line of the existing A494 road.

10.5.9 The significance of the feature is assessed as Negligible, with a Negligible physical impact. The significance of effects is assessed as being Neutral.

Site 43 Aston Quay Building

10.5.10 HER PRN 83033. Aston Quay Building shown on Ordnance Survey 1st edition 25" 1871 at the southwest end of the quay.

10.5.11 No visible trace remains, as the area lies under the line of the existing A494 road.

10.5.12 The significance of the feature is assessed as Medium, with a Negligible physical impact. The significance of effects is assessed as being Neutral.

Site 45 Queensferry Chapel

10.5.13 HER PRN 83034. Queensferry Chapel, in 1842, a Sailors Home was built near the chemical works. This was later converted into a non-conformist chapel and eventually demolished in 1949.

10.5.14 The area lies under industrial development; it is possible that elements of the site may be uncovered.

10.5.15 The significance of the feature is assessed as Negligible, with a Negligible physical impact. The significance of effects is assessed as being Slight.

Site 46 Queensferry Shipyard II

10.5.16 HER PRN 83030. Queensferry Shipyard II shown on Ordnance Survey 2nd edition 25" 1900. Around 1885, Smith and Co. started building small iron vessels and barges on a site 250 yards west of the ferry, later moving to a site adjacent to the small inlet further to the east. In 1892 'Reliance' was built by Messrs J Wilson and Co., and by 1894 the yard was operated by the Queensferry Shipbuilding and Engineering Co. It changed hands again in 1908/09, this time to Isaac J Abdella and Mitchell Ltd, a company which had been formed in 1901 on the Thames and Severn Canal, near Stroud. The company concentrated on lighters and barges, but also made stern-wheel steamers, such as the 'Manoel Tomaz' in 1912, which was destined for Brazil, and the 'Broughton' which went to Nigeria. The yard closed in 1925, although the name continued in other short-lived firms into the 1930s.

10.5.17 The area mostly lies under the embankment of the existing A494, with some parts being included on the bank of the Aston inlet.

10.5.18 The significance of the feature is assessed as Low, with a Negligible physical impact. The significance of effects is assessed as being Slight.

Site 47 Queensferry Chemical works Railway

10.5.19 HER PRN 83031. A system of railway sidings associated with chemical works and shown on the Ordnance Survey 1st edition 25" 1871.

10.5.20 The railway has been removed, and the area lies under industrial development.

10.5.21 The significance of the feature is assessed as Negligible, with a Negligible physical impact. The significance of effects is assessed as being Slight.

Site 48 Aston Quay

10.5.22 HER PRN 83031. Aston Quay, which included a shipyard, sluice and buildings on the south side of the existing road. This is a small port based around the mouth of the Aston inlet. The port developed as a means of exporting coal from the various small mines to the south. A quay developed at Lower, or King's Ferry, for the shipment of coal from about 1740 when the Mancot Tramway was built to link Big Mancot Colliery with the Dee at Mancot Mark. A 21-year lease had been granted to George Hope of Chester by the Glynnes of Hawarden Castle to mine coal at Mancot and use the newly improved navigation along the Dee. Aston Quay, as it came to be known, expanded further following the construction of a second tramway, which extended from Pentrobin Colliery, Buckley.

10.5.23 Although many of the structures relating to the port have been removed or obliterated by construction of the existing A494 road, various components such as the landing stages and wharf around the Aston inlet appear to survive as substantial structures. The work in constructing the new bridge and embankment for the A494 will cover much of the area and remove any elements that still survive.

10.5.24 The significance of the feature is assessed as Medium, with a Negligible physical impact. The significance of effects is assessed as being Slight.

Site 49 Aston railway

10.5.25 HER PRN 37789. Aston railway shown Ordnance Survey 1st edition 25" 1871.

10.5.26 Much of the route of the railway lies under the embankment of the A494.

10.5.27 The significance of the feature is assessed as Low, with a Negligible physical impact. The significance of effects is assessed as being Neutral.

Site 50 Aston Quay Landing Stage IV

10.5.28 HER PRN 83032. Aston Quay Landing Stage IV shown on Ordnance Survey 1st edition 25" 1871.

10.5.29 There is no visible evidence at this location and so it is unknown if anything survives of this asset. Although no evidence for the landing stage is visible, traces of it may survive. The reported position lies in an area that will see much work in construction of the new bridge.

10.5.30 The significance of the feature is assessed as Medium, with a Negligible physical impact. The significance of effects is assessed as being Slight.

Site 51 Aston Quay Landing Stage III

10.5.31 HER PRN 83029. Aston Quay Landing Stage III shown on Ordnance Survey 1st edition 25" 1871. At low tide, four concrete pillars can be seen protruding from the water. These are likely to be the bases for timber uprights forming the structure of the landing stage. Remains of a timber structure are visible on the riverbank. A rectangular concrete block forming part of the structure is present, partly covered in undergrowth. The actual national grid reference is different to that contained in the CPAT HER record.

10.5.32 The remains of the landing stage lie in the line of the proposed bridge. All remaining features are likely to be removed.

10.5.33 The significance of the feature is assessed as Medium, with a Major physical impact. The significance of effects is assessed as being Moderate.

Site 53 Aston Quay Landing Stage V

10.5.34 HER PRN 83054. Aston Quay Landing Stage V shown on Ordnance Survey 1st edition 25" 1871. A few timbers are reported protruding from the riverbank. Nothing was visible during the site visit.

10.5.35 The position lies in an area that will see much work in construction of the new bridge.

10.5.36 The significance of the feature is assessed as Medium, with a Negligible physical impact. The significance of effects is assessed as being Slight.

Site 75 Sluice

10.5.37 HER PRN 214527. Modern sluice, possibly constructed as part of the A494 work in 1960-62.

10.5.38 The location will lie under the line of the earthworks for the proposed A494 road and will be severely impacted.

10.5.39 The significance of the feature is assessed as Low, with a Major physical impact. The significance of effects is assessed as being Neutral.

10.5.40 There is a high potential that intrusive works may uncover previously unrecognised archaeological deposits within the Scheme. The potential for previously unrecorded archaeology has not been quantified at this stage but is likely to be adverse.

10.5.41 A construction contractor has not yet been appointed to the Scheme. Therefore, additional areas of temporary works such as construction yards, haul roads and borrow pits have not been identified. Detailed assessment of any proposed temporary works will be conducted once they are identified. This work will be described in the archaeological management plan as part of the CEMP and part of the actions required to be undertaken by the construction contractor.

Table 10-9 Summary of Impact on Un-designated Historical Assets

Impact	No.
Major	5
Moderate	0
Minor	0
Negligible	7
No change	64
Total	76

Temporary and Permanent Effects

10.5.42 The likely impacts and consequent effects on designated historic assets as a result of the operation of the Scheme are described below, with asset types (e.g. listed buildings) grouped together.

10.5.43 All effects identified and described below should be considered adverse, and permanent unless stated otherwise.

Setting of Designated Assets

10.5.44 Designated assets within a 5 km buffer zone of the borders of the Scheme were assessed for the impact on their settings, using the criteria set out in paragraph 10.3.14. The results show that there are 214 assets in the buffer zone in both Flintshire and Cheshire West (202 Listed Buildings, 9 Scheduled Ancient Monuments and 3 Registered Historic Parks and Gardens). Six were deemed to have an impact upon their setting, of which, all are located in the 500 m Scheme study area. The full list of sites is included in Appendix 10.A.

10.5.45 The designated assets impacted by the Scheme are shown in the sections below. Most of these are a distant view of the Scheme, which largely duplicates the existing view of the road in the landscape. These setting impacts are mostly Slight with a no significant change.

Site 8 Queensferry War Memorial Institution

10.5.46 HER PRN 59396, Cadw 84434, LBII. Queensferry War Memorial Institution opened in 1920. Standing building, long single storey range of corrugated iron sheeting on a brick plinth, with iron sheeting roof. Listed as a little-altered village institute and First World War memorial, retaining its historic character and detail.

10.5.47 The feature lies 430 m from the nearest area of road construction. Evidence from the Lidar model show that there are seven large structures preventing visible interaction with the feature. The feature experiences road noise and vibration from the current road use. This is not likely to change during the Construction and Operation periods of the Scheme.

10.5.48 **Temporary Impacts** related to construction road management activities may occur outside the building. No other changes will be observed from this location. The effect of this is assessed as negligible. **Permanent Impacts** will not occur.

10.5.49 It is recommended that this location is monitored to ensure that any further effects can be controlled during construction.

Site 31 Bascule Bridge

10.5.50 HER PRN 59397 also including HER PRN 87852, Coflein 401387, Cadw 84433 LBII and Cadw 85251 LBII.

10.5.51 The Bascule Bridge was constructed in 1924-26 by Sir Basil Mott. It replaced the Victoria Jubilee Bridge, completed only in 1899, which did not have the size or strength to carry the volume of traffic. The bridge is constructed of riveted I-section steel girders, supported on 2 pairs of large circular piers. The bridge was designed to open, with opening mechanisms, located over the two sets of piers. A frame containing the gearing mechanism, including small gear wheels, is in front of the steel plates, but the original power source has gone. Many of the steel girders are labelled 'Cargo Fleet England', a few marked 'Lanarkshire'. Listed for its technical interest as a rare surviving example of a bascule bridge, retaining its architectural character and detail.

10.5.52 The bridge is 155 m west of the proposed new bridge. The impact of the Scheme on this asset will be negligible. The nearby existing A494 road bridge will be replaced by a bridge of similar design, which will be further away than the existing structure.

10.5.53 **Temporary Impacts** during construction temporary visual effects will occur due to erection of the new bridge and removal of the existing one, which lies in the line of sight of each other. Noise and vibration impact during construction will not be felt at this location. This effect is identified as Slight adverse, but temporary. **Permanent Impacts** during Operation will be restricted to views of the new section of bridge, further away than the existing one, together with traffic flows that will be similar to current occurrences. The effect is assessed as Slight adverse, not significant.

10.5.54 It is recommended that monitoring of this location during construction will ensure that any further effects can be controlled.

Sites 61, 65, 66 Former Willans and Robinson Factory

10.5.55 West Block, HER PRN 59395; including Cadw 85240 LBII; Central Block, HER PRN 59393; and Cadw 85241 LBII; East Block, HER PRN 59394, Cadw 85242 LBII.

10.5.56 Former Willans and Robinson Factory, West, Central and East Blocks. The Factory was built in 1901 by HB Cresswell for Willans & Robinson, manufacturers of water-tube boilers and specialist steels. It was a pioneering example of a factory built on Modernist principles, Nikolaus Pevsner describing it as 'the most advanced British building of its date'. It was designed so that the structural components and detail related to the processes within: The three buildings were flat-topped, as gantries were housed on the roof, requiring support from buttresses which also formed the bay divisions; a dentilled brick course above the window bands provided ventilation. There was originally a tower, now truncated, which housed hydraulic accumulators. The factory was not a financial success and closed in 1910, though Willans & Robinson Ltd continued in Rugby until the 1920s. The works was disused when the First World War broke out in 1914, and it was requisitioned as a prisoner of war camp. The German prisoners left in May 1915, and the works became a munitions factory, mainly producing explosives such as guncotton. It remained an explosives factory well into the twentieth century. Alterations to the buildings took place, such as the removal of parts of the parapets and the addition of gabled roofs, as there was no longer a requirement for overhead gantries. Although the original factory has been compromised, it was designed for a use which was short-lived, and these alterations form an important part of its history. Listed as a pioneering factory designed on Modernist principles, making it a highly significant building of about 1900. The factory's association with the First World War is of additional historic interest.

10.5.57 The three designated locations are 100 m, 165 m, 240 m away from the construction boundary. The setting of the building as a whole will be only marginally changed. A line of trees currently screens the site from the A494 road,

while a large yellow, industrial warehouse conceals the three designated buildings from the existing bridge and will also screen the proposed bridge from view.

10.5.58 **Temporary Impacts** during construction temporary visual effects will occur due to erection of the new bridge and work on the new A494 route using large machinery. Noise and vibration impact during construction will not be felt at this location. This effect is identified as Slight adverse, but temporary. **Permanent Impacts** during Operation will be restricted to views of the new section of bridge, together with traffic flows that will be similar to current occurrences. This will be reduced by the presence of existing large buildings in the vicinity and gradually reduced as the project landscaping matures. Noise and vibration impact during Operation will be similar to those at present. The effect is assessed as Slight adverse, not significant.

10.5.59 It is recommended that monitoring of the location during construction will ensure that any further effects can be controlled.

Site 69 Ferry Bank Farm

10.5.60 HER PRN 59399, including Cadw 85249 LBII. Ferry Bank Farm, probably early nineteenth century and shown on the Tithe map of 1839. Listed as a good early nineteenth century farmhouse retaining its character and detail. A butt joint suggests the house could have been enlarged and heightened, but it is more likely there was a change of plan during construction. Three-storey three-window farmhouse constructed of brick under a slate roof, brick end stacks, external to north end, and stack to front roof pitch. Saw-tooth dentilled eaves to front and rear. Entrance offset slightly left of centre with twentieth century wooden door with glazed strips, under a wedge lintel. Lower farm ranges adjoin the south gable end, a short block with slate roof and truncated brick ridge stack, beyond which is a stone range with corrugated asbestos roof, possibly a barn. There are single-storey ranges at right angles to front and rear, that adjacent to front of house possibly a former bakehouse.

10.5.61 The building will be 100 m away from the proposed road line, which will largely be set in the existing A494 carriageway. The proposed new bridge will be 410 m

away at its closest, while the existing bridge is 430 m away. Although the house is close to the existing road, the view of the bridge will be very similar to the current one. The setting of the building will be marginally changed with a negligible impact. During construction, there will be temporary impacts visible.

10.5.62 **Temporary Impacts** during construction temporary visual effects will occur due to erection of the new bridge and work on the new A494 route using large machinery. Noise and vibration impact during construction will not be felt at this location. This effect is identified as Slight adverse, but temporary. **Permanent Impacts** during Operation will be restricted to views of the new section of bridge, together with traffic flows, noise and vibration that will be similar to current occurrences. The effect is assessed as Slight adverse, not significant.

10.5.63 It is recommended that monitoring of this location during construction will ensure that any further effects can be controlled.

10.6 Mitigation and Monitoring

10.6.1 Within the description of impacts in Section 10.5, specifically regarding buried archaeological remains, a programme of further archaeological investigation is outlined.

10.6.2 However, it should be noted that the implementation of the programme of further archaeological work would not result in the avoidance or reduction of the potential impacts and effects described above, rather it would serve to 'offset' the adverse nature of the effects through the provision of information which can be disseminated through appropriate media to the widest possible audience.

10.6.3 Further archaeological investigation is proposed at four locations within the land take required for the construction of the Scheme Sites 48, 51, 50 and 53). These are all in the vicinity of the Aston Inlet and form components associated with the Aston Quay port. The most appropriate mitigation action for these is that during the site clearance phase, a limited scale strip and record action is undertaken to expose and record any evidence present on the side of the Aston Quay and under the toe of the existing road and bridge embankment.

10.6.4 An archaeological watching brief would be undertaken on a targeted basis, focusing on specific impact types and locations. This may lead to a requirement for further archaeological investigation of any buried archaeological remains that are identified during the watching brief.

10.6.5 The monitoring of the project would include oversight of the effects of construction on the six locations of Listed Buildings (sites 8, 31, 61, 65, 66 and 69).

10.7 Assessment of Effects after Monitoring

10.7.1 As set out above, the proposed mitigation would not result in the avoidance or reduction of the potential impacts and effects described above. Therefore, the magnitude of impacts and significance of effects would not change. The assessment of land take, construction and operational effects would therefore remain as reported.

10.8 Assessment of Cumulative Effects

10.8.1 No cumulative impacts were identified for historic assets.

Inter-relationships

10.8.2 Each of the potential inter-relations between cultural heritage and other aspects of the Scheme (e.g. traffic, visibility, etc.) have been covered within the various sections of the assessment. The main inter-action is between the common elements of the cultural heritage landscape. This is an industrial period setting with all components directly related to the River Dee using the riverbank as a location for shipbuilding, wharfs for loading coal from rail to ships and long-distance communication routes. All these helped in creating the environment for the development of Queensferry against a background of maritime trade and cross-river communication.

10.9 Overall Effect on Historic assets

10.9.1 The study found that assets of cultural heritage value were distributed throughout the study area. These were primarily of built historic assets dating from the nineteenth and twentieth centuries. Detailed study is needed on the sites

associated with Aston Quay that appear to be severely affected by construction of the eastern bridge. This damage will complete the considerable impact of the existing A494 embankment and bridge construction.

10.10 Summary of Effects

10.10.1 This assessment has identified that the implementation of the Scheme would result in an adverse effect on several historic assets. This results from physical damage to some assets and a limited impact on the visual setting of some assets that are not physically affected.

10.10.2 There will be a major impact on five Un-designated assets identified in this study. These are Aston Quay (Site 48), Aston Quay Landing Stage IV (Site 50), Aston Quay Landing Stage III (Site 51), Aston Quay Landing Stage V (Site 53) and a sluice (Site 75).

10.10.3 Eleven Un-designated assets will receive a negligible impact. These are all features that have either been demolished or located under the embankment of the present A494 road or are further away from the limits of construction. The sites are Aston Hall Colliery Railway (Site 11), Aston Quay Weighbridge (Site 37), Aston Quay Building (Site 43), Queensferry Chapel (Site 45), Queensferry Shipyard II (Site 46), Queensferry Chemical Works Railway (Site 47), Aston Railway (Site 49),

10.10.4 Seven Designated sites will receive a Slight adverse, but not significant impact to their setting. The are the Bascule Bridge (Site 31), Former Willans & Robinson Factory West Block (Site 61), Former Willans & Robinson Factory Central Block (Site 65), Former Willans & Robinson Factory East Block (Site 69) and Ferry Bank Farm (Site 69). One Designated site will receive a Negligible, temporary impact (Site 8).

Table 10-10 Summary of Significance of Effect on Assets

Site Reference	Name of asset identified in this study (Designated assets in bold)	Physical	Temporary	Operation
Site 8	**Queensferry War Memorial Institution**		Negligible	
Site 11	Aston Hall Colliery Railway	Negligible		

Site Reference	Name of asset identified in this study (Designated assets in bold)	Physical	Temporary	Operation
Site 31	**Bascule Bridge**		Slight	Slight
Site 37	Aston Quay Weighbridge	Neutral		
Site 43	Aston Quay Building	Neutral		
Site 45	Queensferry Chapel	Slight		
Site 46	Queensferry Shipyard II	Slight		
Site 47	Queensferry Chemical Works Railway	Slight		
Site 48	Aston Quay	Slight		
Site 49	Aston Railway	Neutral		
Site 50	Aston Quay Landing Stage IV	Slight		
Site 51	Aston Quay Landing Stage III	Moderate		
Site 53	Aston Quay Landing Stage V	Slight		
Site 61	**Former Willans & Robinson Factory West Block**		Slight	Slight
Site 65	**Former Willans & Robinson Factory Central Block**		Slight	Slight
Site 66	**Former Willans & Robinson Factory East Block**		Slight	Slight
Site 69	**Ferry Bank Farm**		Slight	Slight
Site 75	Sluice	Neutral		

10.11 Monitoring

10.11.1 There is no significant cultural heritage impact that requires future archaeological monitoring during the operation of the scheme after construction. Landscape and visual measures will provide mitigation for impacts on the settings of cultural heritage resources in the surrounding study area.

Project Design Approval, Archiving and Reporting of Archaeological Assessments

10.11.2 The reporting and archiving of archaeological reports produced for this assessment and those produced if the Dee Bridge Scheme is constructed, shall be submitted as a high-resolution digital pdf to Heneb: Clwyd Powys Archaeology Historic Environment Record, to be sent, in accordance with the Heneb HER submission guidelines. The full digital archive will be forwarded to the National Monuments Record, RCAHMW, Aberystwyth and/or the Archaeology Data Service in accordance with their submission guidelines.

Llywodraeth Cymru / Welsh Government

A494 RIVER DEE BRIDGE REPLACEMENT SCHEME

Environmental Statement

Volume 1: Technical Assessment Report

Chapter 11: Air Quality

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11. Air Quality

11.1 Introduction

11.1.1 This Chapter presents the information required by the Infrastructure Planning (Environmental Impact Assessment (EIA)) (Miscellaneous Amendments Relating to Harbours, Highways and Transport) Regulations 2017) to be provided in the Environmental Statement (ES) to enable the identification and assessment of likely significant effects on air quality.

11.1.2 The Scheme has the potential to cause both adverse and beneficial effects. This Chapter includes:

- A description of the assessment methodology and identification of the study area.
- A review of air quality baseline conditions within the study area.
- Assessment of the potential impacts associated with construction dust and traffic management measures on sensitive human health receptors and designated habitats within the study area.
- Assessment of the potential air quality impacts of the Scheme on sensitive human health receptors and designated habitats within the study area.
- Assessment of the risk to affecting the UK's reported ability to comply with the Air Quality Directive[1], as transposed into UK law[2], in the shortest timescales possible.
- Inclusion of mitigation measures, where relevant, and summary of overall significance of effects.

11.1.3 This assessment considers both construction and operational phase effects and has been prepared in accordance with the Design Manual for Roads and Bridges (DMRB) LA 105 Air Quality[3].

[1] European Union (2008) Directive on Ambient Air Quality and Cleaner Air for Europe, Directive 2008/50/EC Official Journal, vol. 152, pp. 0001-0044. Available at: https://www.legislation.gov.uk/eudr/2008/50/contents
[2] The Air Quality Standards (Wales) Regulations 2010 implement the requirements of the EU Directive 2008/50/EC. However, the Air Quality Directive is referred to within this assessment, as DMRB LA 105 still refers to the Air Quality Directive rather than The Air Quality Standards (Wales) Regulations 2010, despite the UK no longer being in the EU.
[3] National Highways (June 2024) DMRB LA 105 – Air Quality. Available at: https://www.standardsforhighways.co.uk/search/af7f4cda-08f7-4f16-a89f-e30da703f3f4

11.1.4 This Chapter has been undertaken in compliance with the Scoping Report submitted in December 2024. In line with the Scoping Report, construction plant emissions have been scoped out of the assessment. Guidance from the Institute of Air Quality Management (IAQM)[4] notes that effects from on-site plant exhausts would likely not be significant. Given the local and temporary nature of construction plant, their emissions are considered to have negligible impact on local air quality relative to the surrounding road traffic contributions on the local road network. Construction plant emissions are controlled by The Non-Road Mobile Machinery (Type-Approval and Emission of Gaseous and Particulate Pollutants) Regulations 2018 and would meet the required pollutant emission limits. Construction plant emissions have therefore been scoped out as the impacts would be negligible and not significant.

11.1.5 This Chapter should be read in parallel with Chapter 8 (Biodiversity), Chapter 14 (Population and Human Health) and Chapter 16 (Cumulative Effects) of this ES.

11.2 Legislation and Policy Framework

National Legislation

11.2.1 The Air Quality Standards (Wales) Regulations 2010[5] (amended by The Air Quality Standards (amendment) Regulations 2016, The Air Quality Standards (Wales) (Amendment) (EU Exit) Regulations 2019[6] and the Environment (Miscellaneous Amendments) (EU Exit) Regulations 2020[7]) implement Directive 2008/50/EC[1] on ambient air quality.

11.2.2 These pieces of legislation define limit values, and times by which they are to be achieved, for the purpose of protecting human health and the

[4] IAQM (2024) Guidance on the assessment of dust from demolition and construction. Available at: https://iaqm.co.uk/wp-content/uploads/2013/02/Construction-Dust-Guidance-Jan-2024.pdf
[5] Statutory Instrument (2010) The Air Quality Standards (Wales) Regulations
[6] Statutory Instrument (2019) The Air Quality Standards (Wales) (Amendment) (EU Exit) Regulations
[7] Statutory Instrument (2020) Environment (Miscellaneous Amendments) (EU Exit) Regulations 2020, No. 1313.

environment by avoiding, reducing, or preventing harmful concentrations of air pollutants.

11.2.3 The limit values apply everywhere, with the exception of:

- Any locations situated within areas where members of the public do not have access and there is no fixed habitation.
- On factory premises or at industrial installations to which all relevant provisions concerning health and safety at work apply.
- On the carriageway of roads.
- On the central reservations of roads except where there is normally pedestrian access to the central reservation.

11.2.4 The Department for Environment Food and Rural Affairs (Defra) assesses and reports on the compliance with the limit values for each of the 43 zones and agglomerations across the UK. Zones and / or agglomerations achieve compliance when the zone and/or agglomeration (except locations provided in the Directive) does not exceed the relevant limit value. The Scheme is located within the North Wales Zone (UK0042). In July 2017, Defra published the 'Air Quality Plan for tackling roadside nitrogen dioxide concentrations in North Wales (UK0042)'[8]. The plan presents general information regarding this zone, as well as details of nitrogen dioxide (NO_2) exceedances within the zone and details of local air quality measures that have been or will be implemented, or are being considered for implementation. The assessment undertaken for the North Wales Zone indicates that the annual limit value was predicted to be exceeded between 2015 and 2020 but was expected to be achieved in 2021 through the implementation of measures across the zone, combined with other measures implemented across the UK.

11.2.5 This Chapter demonstrates that non-compliance with the annual mean limit value for NO_2 is no longer an issue. As stated in paragraph 11.6.20, based on Defra's Pollution Climate Mapping (PCM) model outputs, there

[8] Department for Environment Food and Rural Affairs. (2017) Air Quality Plan for Tackling roadside nitrogen dioxide concentrations in North Wales (UK0042). Available at: https://uk-air.defra.gov.uk/assets/documents/no2ten/2017-zone-plans/AQplans_UK0042.pdf

are no PCM links in the vicinity of the Scheme that exceed the annual mean NO_2 limit value of 40µg/m^3 for the base year of 2023 or opening year of 2029. There is one PCM link that intersects the Scheme boundary and ARN (PCM link model ID 802030571), as shown in Figure 11-7. This link has predicted annual mean NO_2 concentrations of 34.8µg/m^3 and 24.4µg/m^3 in 2023 and 2029 respectively which are below the limit value of 40µg/m^3. In addition, as detailed in paragraph 11.6.16, the Scheme-specific air quality monitoring survey undertaken in 2024 recorded no exceedances of the NO_2 annual mean air quality objective of 40µg/m^3 at roadside locations across the study area, with a maximum concentration of 28.4µg/m^3 monitored along the A494 River Dee Bridge at the roadside diffusion tube D5.

11.2.6 Part IV of the Environment Act 1995[9] (as amended in Schedule 11 of the Environment Act 2021[10]) requires that every local authority shall periodically carry out a review of air quality within its area, including predictions of likely future air quality. The air quality objectives specifically for use by local authorities in carrying out their air quality management duties are set out in The Air Quality (Wales) Regulations 2000[11] and The Air Quality (Wales) (Amendment) Regulations 2002[12]. In most cases, the air quality objectives are set at the same pollutant concentrations as the limit values transposed in UK law, although compliance dates differ.

11.2.7 As part of the review of air quality, the local authority must assess whether air quality objectives are being achieved, or likely to be achieved within the relevant periods and identify the key sources of emissions responsible for the failure to achieve the objectives. Any parts of a local authority's area where the objectives are not being achieved or are not likely to be achieved within the relevant period must be identified and declared as an Air Quality Management Area (AQMA). Once such a declaration has been

[9] Department for Environment Food and Rural Affairs. (2003) Part IV of the Environment Act 1995 Local Air Quality Management
[10] Statutory Instrument. (2021) Chapter 30, Schedule 11 Local Air Quality Management Framework of Environment Act 2021
[11] Statutory Instrument (2000) The Air Quality (Wales) Regulations, No. 1940 (W.138).
[12] Statutory Instrument (2002) The Air Quality (Amendment) (Wales) Regulations, No. 3182 (W.298).

made, local authorities are under a duty to prepare an Action Plan which sets out measures to pursue the achievement of the air quality objectives within the AQMA.

11.2.8 The Environment Act requires the UK Government to produce a national Air Quality Strategy (AQS). The AQS establishes the UK framework for air quality improvements. The previous AQS[13] and its subsequent iterations, have now been superseded as of the 14th January 2019 with the Clean Air Strategy 2019 (CAS)[14].

11.2.9 The CAS does not set legally binding objectives, the CAS instead has targets for reducing total UK emissions of nitrogen oxides (NOx) and fine particulate matter ($PM_{2.5}$) from sectors such as road transport, domestic sources and construction plant (non-road mobile machinery).

11.2.10 The UK Government produced a revised AQS in 2023. This revision replaces the 2007 strategy and compliments the CAS. The 2023 revision sets out the actions the government expects local authorities in England to take in support of achieving the Government's long-term air quality goals, including their two new long-term $PM_{2.5}$ targets. The AQS does not include local authorities in Wales and as such the long-term $PM_{2.5}$ targets currently only apply to England. Therefore, the revised AQS and new targets are not applicable to this Scheme.

11.2.11 The Environment (Air Quality and Soundscapes) (Wales) Act 2024[15] became law in Wales on 14th February 2024 to make provision for improving air quality. The Act requires Welsh Ministers to set a $PM_{2.5}$ air quality target within three years of this date. However, it is not currently known what this target may be and as such it will not be considered in the assessment. In September 2024, the Welsh Government provided an

[13] Department for Environment Food and Rural Affairs. (July 2007), 'The Air Quality Strategy for England, Scotland, Wales and Northern Ireland', Cm 7169, Department for Environment Food and Rural Affairs.
[14] Department for Environment Food and Rural Affairs. (January 2019), 'The Clean Air Strategy'
[15] Acts of Welsh Parliament (2024) Environment (Air Quality and Soundscapes) (Wales) Act 2024

update on the development of the $PM_{2.5}$ target[16]. It is proposed that evidenced targets will be developed by Spring 2025, public consultation will be undertaken during Autumn 2025 and responses to the consultation will be published in Spring 2026. The final laying of target legislation is expected to take place during Autumn 2026.

11.2.12 The Welsh Government published the 'Clean Air Plan' for Wales[17] in 2019 to provide a framework and actions for air quality improvements within Wales.

11.2.13 Air quality objectives and limit values relevant to the Scheme are summarised in Table 11-1.

Table 11-1 Relevant air quality objectives and limit values

Pollutant	Averaging period	Concentration	Allowance	Attainment date	
				Air quality objectives	Limit values
NO_2	Annual	40µg/m^3	-	31 December 2005[(a)]	1 January 2010[(c)]
	1 Hour	200µg/m^3	18	31 December 2005[(a)]	1 January 2010[(c)]
Particulates less than 10 microns in diameter (PM_{10})	Annual	40µg/m^3	-	31 December 2004[(a)]	1 January 2005[(c)]
	24 Hour	50µg/m^3	35	31 December 2004[(a)]	1 January 2005[(c)]

[16] Welsh Government (2024) The Clean Air Plan for Wales Healthy Air, Healthy Wales. Update Report on Progress Against Actions. Available at: https://www.gov.wales/sites/default/files/publications/2024-09/clean-air-plan-update-report-on-progress-against-actions.pdf
[17] Welsh Government (2019) Clean Air Plan for Wales: Healthy Air, Healthy Wales

Pollutant	Averaging period	Concentration	Allowance	Attainment date	
				Air quality objectives	Limit values
Fine particulates less than 2.5 microns in diameter ($PM_{2.5}$)[e]	Annual	20µg/m^3	-	-	1 January 2020[f]
		25µg/m^3	-	2020[b]	-
Oxides of nitrogen (NOx)[d]	Annual	30µg/m^3	-	31 December 2000[a]	19 July 2001[c]

Notes: (a) The Air Quality (Wales) Regulations 2000 as amended
(b) Air Quality Strategy 2007
(c) The Air Quality Standards (Wales) Regulations 2010 (as amended)
(d) Designated for the protection of vegetation and ecosystems and also referred to as the 'critical level' for NOx. The policy of the UK statutory nature conservation agencies is to apply the annual mean NOx criterion in internationally designated conservation sites and Site of Special Scientific Interest (SSSI) on a precautionary basis, as the limit value applies only to locations more than 20km from towns with more than 250,000 inhabitants or more than 5km from other built-up areas, industrial installations or motorways.
(e) As the Air Quality Strategy 2007 and the Air Quality Standards Regulations 2010 (as amended) have a different numerical standard for $PM_{2.5}$, the more stringent standard of 20µg/m^3 has been adopted for this assessment.
(f) The Air Quality Standards Regulations 2010 (as amended)

11.2.14 Table 11-2 provides details of where the respective objectives should and should not apply and therefore the types of receptors that are relevant to the assessment of air quality.

Table 11-2 Locations where the air quality objectives apply

Averaging period	Objectives should apply at:	Objectives should not apply at:
Annual	All locations where members of the public might be regularly exposed. Building façades of residential properties, schools, hospitals, care homes, etc.	Building façades of offices or other places of work where members of the public do not have regular access. Hotels, unless people live there as their permanent residence. Gardens of residential properties. Kerbside sites (as opposed to locations at the building façade), or any other location where public exposure is expected to be short-term.
24-Hour	All locations where the annual mean objective would apply, together with hotels. Gardens of residential properties.	Kerbside sites (as opposed to locations at the building façade), or any other location where public exposure is expected to be short-term.

Averaging period	Objectives should apply at:	Objectives should not apply at:
1-Hour	All locations where the annual mean and 24-hour mean objectives apply. Kerbside sites (for example, pavements of busy shopping streets). Those parts of car parks, bus stations and railway stations, etc., which are not fully enclosed, where members of the public might reasonably be expected to spend one hour or more. Any outdoor locations where members of the public might reasonably be expected to spend one hour or longer.	Kerbside sites where the public would not be expected to have regular access.

Source: Defra Local Air Quality Management Technical Guidance (LAQM TG22)[18]

11.2.15 Section 79(1)(d) of the Environmental Protection Act 1990[19] defines one type of 'statutory nuisance' as "any dust, steam, smell or other effluvia arising on industrial, trade or business premises and being prejudicial to health or a nuisance". Where a local authority is satisfied that a statutory nuisance exists, or is likely to occur or recur, it must serve an abatement notice. Failure to comply with an abatement notice is an offence. Best

[18] Department for Environment, Food and Rural Affairs and Devolved Administrations (2022) Local Air Quality Management – Technical Guidance LAQM.TG22
[19] Parliament of the United Kingdom (1990) Environmental Protection Act 1990

practicable means is a widely-used defence by operators, if employed to prevent or to counteract the effects of the nuisance.

National Planning Policy

11.2.16 The current air quality planning policies for the Welsh Government are set out in Planning Policy Wales Edition 12 (July 2024)[20]. Those relating to air quality and of relevance to this Chapter of the ES include:

- Chapter 3 'Strategic and Spatial Choices', which highlights the importance of promoting healthier places through the planning system. This includes enabling opportunities for outdoor activities, good design in planning to minimise exposure to poor air quality, reduction of health inequalities and making positive contributions to environmental protection and improvement, including air quality.
- Chapter 4 'Active and Social Places', which states that the Welsh Government is committed to supporting modal shift from private cars to walking, cycling and public transport and that local authorities must adopt an integrated approach to traffic management, also considering wider planning objectives such as improvement in air quality.
- Chapter 6 'Distinctive and Natural Places' states that development plan strategies, policies and development proposals should look to the long-term protection and enhancement of the built and natural environment in order to achieve Wales's wellbeing goals. This includes considering effects of development proposals on air quality with the aim to reduce population exposure to air pollution in Wales.

11.2.17 Planning Policy Wales (PPW) is supplemented by a series of topic-based Technical Advice Notes (TANs). TAN 18 Transport[21] details the importance of good air quality, and states: '*well designed and implemented traffic management can help secure planning objectives…[by]… reducing…local air pollution…*'.

11.2.18 In June 2017, the Welsh Government set out further provisions in Policy guidance PG(W)(17)[22], which adopts five ways of working set out in the

[20] Welsh Government (2024) Planning Policy Wales. Edition 12. Available at: https://www.gov.wales/sites/default/files/publications/2024-07/planning-policy-wales-edition-12.pdf
[21] Welsh Government (2007) Planning Policy Wales Technical Advice Note 10: Transport. Available at: https://www.gov.wales/sites/default/files/publications/2018-09/tan18-transport.pdf
[22] Welsh Government (2017) Local air quality management in Wales. Part of the Environment Act 1995. Policy guidance PG(W)(17)

Well-being of Future Generations (Wales) Act 2015[23] with the intention to improve the economic, social, environmental and cultural well-being of Wales in accordance with the sustainable development principles. The five ways of working are:

- *'looking to the long term so we do not compromise the ability of future generations to meet their own needs;*
- *taking an integrated approach;*
- *involving a diversity of the population in the decisions affecting them;*
- *working with others in a collaborative way to find shared sustainable solutions; and*
- *acting to prevent problems from occurring or getting worse.'*

11.2.19 Local authorities in Wales are expected to follow these ways of working when carrying out their Local Air Quality Management (LAQM) duties.

11.2.20 The Welsh Government published The Wales Transport Strategy 2021[24] in 2021, which sets out the Government's main transport development aims and how these will be achieved. The strategy contains long-term environmental outcomes for transport in Wales. In relation to air quality, the strategy aims to '*improve air quality by pursuing modal shift, encouraging more active travel, greater use of public transport and low emissions vehicles, and by creating closer links between land-use planning and transport in line with our commitments in the Clean Air Plan for Wales: Healthy Air, Healthy Wales*'.

[23] Welsh Government (2015) Well-being of Future Generations (Wales) Act 2015
[24] Welsh Assembly Government (2021) The Wales Transport Strategy. Available at: https://www.gov.wales/sites/default/files/publications/2021-03/llwybr-newydd-wales-transport-strategy-2021-full-strategy_0.pdf

Local Planning Policy

11.2.21 Flintshire County Council (FCC) adopted their Local Development Plan 2015-2030[25] in 2023. Air quality policies within the Local Development Plan include strategic policy STR14, PC2 and EN18:

11.2.22 Policy STR14: Climate Change and Environmental Protection requires:

- *'The Council will seek to mitigate the effects of climate change and ensure appropriate environmental protection in the County through:…*
- *vi: Ensuring that new development has regard to the protection of the environment in terms of air, noise and light pollution, unstable and contaminated land and former landfill sites'*

11.2.23 Policy PC2: General Requirements for Development requires:

- *'All development should: …*
- *b. not have a significant adverse impact on the safety and living conditions of nearby residents, other users of nearby land/property, or the community in general, through increased activity, disturbance, noise, dust, vibration, hazard, or the adverse effects of pollution…*
- *f. not result in or be susceptible to problems related to foul and surface water drainage, land stability, contamination, flooding, or pollution of light, air and water, either on or off site'*

11.2.24 Policy EN18: Pollution and Nuisance requires:

- *New development which would create an increased risk of noise, vibration, odour, dust, light or other pollution or hazard will only be permitted if:*
- *a. it would not unacceptably harm general amenity or living conditions; and*
- *b. it would not impose significant restrictions on the use or development of surrounding land.'*

[25] Flintshire County Council (2023) Flintshire Local Development Plan 2015-2030. Available at: https://www.flintshire.gov.uk/en/PDFFiles/Planning/Examination-Library-Documents/FINAL-LDP-Written-Statement-English.pdf

Neighbouring Authorities

11.2.25 The Cheshire West and Chester Local Plan (Part Two)[26], which contains the relevant policies for air quality, was adopted 18th July 2019. The administrative area of Cheshire West and Chester Council (CWCC) is located 2.5km northeast of the Scheme. Policy DM 31 – Air Quality states *'development must not give rise to significant adverse impacts on health and quality of life, from air pollution'.*

11.3 Assessment Methodology

11.3.1 This section outlines the method used to assess how the Scheme's construction and operation may impact air quality. The scope of the air quality assessment was presented in Chapter 11 Air Quality of the Environmental Scoping Report submitted in December 2024. Potential air quality effects have been assessed in accordance with the DMRB LA 105[3].

11.3.2 The assessment comprises the:

- Assessment of the potential impacts associated with the construction phase including consideration of construction dust, construction traffic and traffic management measures on sensitive human health receptors and designated habitats within the study area.
- Assessment of the potential impacts associated with the operation phase, including
    - assessment of the potential air quality impacts of the Scheme on sensitive human health receptors and designated habitats within the study area
    - assessment of the risk to affecting the UK's reported ability to comply with the Air Quality Directive[1], as transposed into UK law[2], in the shortest timescales possible.

[26] Chester West and Chester Council Local Plan (Part Two) Land Allocations and Detailed Policies. Available at: https://consult.cheshirewestandchester.gov.uk/kse/event/34617

Construction Phase

Construction Dust

11.3.3 DMRB LA 105 requires that a qualitative assessment of potential dust effects is undertaken based on a review of likely dust raising activities, and identification of sensitive receptors within 50m, 100m and 200m of these activities. The results from the qualitative assessment are presented in Section 11.9 of this Chapter and have been used to inform the best practice mitigation measures presented in Section 11.7 of this Chapter and in the Construction Environmental Management Plan (CEMP).

Construction Traffic

11.3.4 During the construction phase, the Scheme would introduce new emission sources in the form of traffic from construction vehicles and the implementation of traffic management measures.

11.3.5 DMRB LA 105 requires that assessment of construction traffic movements are assessed where construction activities are programmed to last for more than two years and exceed the traffic scoping criteria:

- Annual average daily traffic (AADT) >=1,000; or
- Heavy duty vehicle (HDV) [27] AADT >= 200; or
- A change in speed band[28]; or
- A change in carriageway alignment by >= 5 metres

11.3.6 Notwithstanding the above criteria, as stated in DMRB LA 105, the assessment of construction traffic impacts on sensitive receptors shall be proportionate and limited to areas of key risk of exceeding air quality thresholds.

[27] HDVs include goods vehicles with a gross weight greater than 3.5 tonnes and buses and coaches
[28] Unadjusted traffic model speeds will be used to define the speed bands for individual links within the traffic model for the purpose of defining study area

11.3.7 The construction phase of the Scheme is programmed to last for up to two years starting in 2027 and ending in 2028. As discussed in Section 11.6 Baseline Conditions, there are also no locations within the study area at risk of exceeding air quality thresholds.

11.3.8 On this basis and in accordance with the requirements of the DMRB LA 105, it is unlikely that changes in ambient concentrations caused by the construction phase of the Scheme would cause a new exceedance of an air quality threshold or exacerbate an existing exceedance and therefore changes in air quality would not be significant.

11.3.9 Nevertheless, the introduction of construction vehicles on the strategic road network accessing the Scheme works area and the implementation of traffic management measures during the construction phase, which are detailed in paragraph 11.5.4, have the potential to affect air quality at sensitive receptors within 200m of where they are implemented and their impacts have been discussed qualitatively in Section 11.9 of this Chapter.

Operation Phase

Overview

11.3.10 The operation phase assessment includes:

- quantitative assessment of the changes in pollutant concentrations at sensitive human health receptors for comparison with the air quality objectives;
- quantitative assessment of changes in NO_2 concentrations at qualifying features to assess limit value compliance; and
- qualitative assessment of the change in nitrogen deposition at designated sites.

Pollutants

11.3.11 The air quality assessment has considered emissions of NOx and ammonia (NH_3).

11.3.12 In accordance with DMRB LA 105, PM_{10} has not been considered further within the air quality assessment. This is because:

- DMRB LA 105 states that it is only necessary to model PM_{10} for the base year (2023) to demonstrate that the Scheme does not impact the achievement of the PM_{10} air quality thresholds. Paragraph 11.3.47 provides further detail on the base year.
- The results of the base year PM_{10} modelling presented in Appendix 11.A (Modelled Particulate Matter Results) of the Air Quality ES Appendices show that the highest annual mean PM_{10} concentration is 14.7µg/m^3, which is predicted at human health receptor HH1 and well below the air quality objective of 40µg/m^3. The annual mean PM_{10} background concentration at this receptor is 10.3µg/m^3.
- As the air quality modelling does not show any exceedances of the PM_{10} air quality objective in the base year, PM_{10} has not been included in the air quality model in the Do-Minimum (DM) and D-Something (DS) scenarios and has not been assessed further.

11.3.13 $PM_{2.5}$ has not been considered as DMRB LA 105 states that there should be no need to model $PM_{2.5}$ as the UK currently meets its legal requirements for the achievement of the $PM_{2.5}$ air quality thresholds and the modelling of PM_{10} can be used to demonstrate that the Scheme does not impact on the $PM_{2.5}$ air quality threshold, as explained below.

11.3.14 As mentioned in paragraph 11.3.12 above, the highest annual mean PM_{10} concentration across the modelled human health receptors in the base year of 2023 is predicted to be 14.7µg/m^3, which is below the $PM_{2.5}$ threshold of 20µg/m^3. $PM_{2.5}$ is a constituent part of PM_{10}, which means ambient concentrations and vehicles emission factors for $PM_{2.5}$ are lower than those for PM_{10}.

11.3.15 $PM_{2.5}$ background concentrations are expected to continue falling in the future, due to the uptake of cleaner vehicles and technologies. For example, the maximum $PM_{2.5}$ background concentration from Defra's background maps across the human health receptors assessed is 6.8µg/m^3 in the base year of 2023, compared to 6.3µg/m^3 in the opening year of 2029.

11.3.16 As the current and future $PM_{2.5}$ concentrations are lower than the objective value of 20µg/m^3 and the Scheme will not impact the achievement of the $PM_{2.5}$ air quality threshold at any of the human health receptors considered, there are no likely significant effects for $PM_{2.5}$ and this pollutant is not considered further.

11.3.17 The new $PM_{2.5}$ air quality target for Wales is expected to be set by Welsh Ministers by February 2027. Consequently, it has not been included in this assessment. If the forthcoming Welsh target is aligned with England's 2040 target, set at 10µg/m^3, it is similarly unlikely that the new target value for Wales would be exceeded. Annual mean $PM_{2.5}$ concentrations are likely to be below the target value of 10ugm^3, as the $PM_{2.5}$ background concentration is predicted to be 6.8µg/m^3 in the base year of 2023, which is expected to continue to reduce in the future. Changes in $PM_{2.5}$ concentrations from changes in road alignment will be imperceptible. $PM_{2.5}$ is a constituent part of PM_{10}, which means ambient concentrations and vehicles emission factors for $PM_{2.5}$ are lower than those for PM_{10}. The greatest increase in annual mean PM_{10} concentrations at modelled receptors in the opening year of the Scheme is predicted to be 0.3µg/m^3 between the with and without Scheme scenarios. Changes in $PM_{2.5}$ would therefore be even lower in the opening year of the Scheme. On this basis, it is unlikely that future concentrations of $PM_{2.5}$ would exceed new $PM_{2.5}$ targets in future years and the Scheme is unlikely to cause a significant change in $PM_{2.5}$ concentrations.

Screening Criteria

11.3.18 In accordance with DMRB LA 105, the following traffic scoping criteria have been used to determine the extent of the study area, which are based on the changes in traffic and carriageway alignment between the DM and DS scenarios in the opening year of 2029.

11.3.19 The criteria are:

- Annual average daily traffic (AADT) >=1,000; or

- Heavy duty vehicle (HDV) AADT >= 200; or
- A change in speed band; or
- A change in carriageway alignment by >= 5 metres

11.3.20 During the operational phase, the Scheme would alter parts of the existing road network through the realignment of the A494 River Dee Bridge. There are no expected changes in traffic composition (number of vehicles or speed) as the Scheme is a like for like replacement of the existing A494 River Dee Bridge.

11.3.21 The above criteria have therefore only been met along the A494 where there is a change in carriageway alignment by more than 5m. The roads which meet these criteria are known as the affected road network (ARN) and the area within 200m from the ARN forms the study area of the operational phase of the Scheme. Further detail on the ARN is provided in Section 11.5 of this Chapter.

Operational Traffic Data

11.3.22 Outputs from the SATURN traffic model developed for the Scheme have been used for this assessment. Data on vehicle flows, speed and percent of HDVs are available for the following periods in the base (2023) and opening year (2029). The same set of traffic data for the opening year has been used for both DM and DS scenarios given that there are not expected to be any change in traffic composition.

- AM peak period (07:00 to 10:00)
- Inter-peak period (10:00 to 16:00)
- PM peak period (16:00 to 19:00)
- Off-peak period (19:00 to 07:00)

11.3.23 The diurnal traffic flow characteristics, and therefore emissions, are represented in the dispersion model using time varying emission factors.

11.3.24 Speed data has also been derived from the SATURN traffic model. Appendix 11.A (SATURN Traffic Data Report) of the Air Quality ES Appendices provides a summary of traffic data for the study area.

11.3.25 Committed developments with potential to generate traffic have been incorporated into the traffic model developed for this Scheme along with future traffic growth. Discussion of committed developments included within the traffic model is presented within the NWTM – A494 Highway Model Traffic Forecasting Report (395318-MMD-00-XX-RP-Z-0032_A494_TFR_RevA.pdf). The cumulative effect of the Scheme with other committed developments included within the traffic model has therefore been accounted for within this Chapter for operational effects.

Assessment Scenarios

11.3.26 This assessment has considered the following scenarios:

- Base year 2023 – for model verification (see paragraph 11.3.47)
- Projected base year 2029 – to account for uncertainty in future pollutant projections (see paragraphs 11.3.48 to 11.3.50).
- DM scenario 2029 (opening year without scheme)
- DS scenario 2029 (opening year with Scheme)

11.3.27 The air quality assessment has compared predicted concentrations against the air quality objectives and assessed compliance with the Air Quality Directive for the opening year of the Scheme only. The opening year of the Scheme is expected to be a worst-case in terms of air quality impacts, as noted in paragraph 2.89 of DMRB LA 105, due to background concentrations improving in future years. Air quality is predicted to improve in future years in response to the uptake of vehicles which meet more stringent emissions standards. This is described further in the context of the assumptions used in the assessment in paragraphs 11.3.48 to 11.3.50 of this Chapter and is consistent with the approach outlined within DMRB LA 105.

Model Selection

11.3.28 This assessment has used a dispersion model called ADMS-Roads (version 5.0.1.3), a PC-based model of dispersion in the atmosphere of pollutants released from road traffic sources, produced and validated by Cambridge Environmental Research Consultants (CERC).

11.3.29 The dispersion model was built by digitising traffic model links and assigning road widths based on aerial mapping. The highway design associated with the DS scenario was digitised based on a geo-referenced CAD drawing of the Scheme. Road widths and alignments were adjusted to represent the Scheme design.

Model Parameters and Inputs

Vehicle Emission Factors

11.3.30 Road traffic emission factors for NOx have been derived from speed band emission factors published in DMRB LA 105. The speed band emission factors used in this assessment, v5.1, take account of Defra's Emission Factor Toolkit (EFT) v12.1 released in August 2024. Emissions have been defined according to the speed band category of the traffic link or road.

11.3.31 Although DMRB LA 105 provides predictions of future emissions, there remains some uncertainty over these forecasts. This uncertainty has been addressed when assessing the air quality impact of the Scheme on human health receptors through applying long-term trend (LTTE6) gap analysis factors to uplift opening year concentrations, as described in paragraphs 11.3.48 to 11.3.50. However, in accordance with paragraph 2.54 in DMRB LA 105, the LTT gap analysis factors have not been applied to the air quality modelling results for the compliance risk assessment, in order to ensure that the assessment is consistent with Defra's reporting on compliance with the limit values.

11.3.32 A time varying emission file has been used to represent vehicle emissions for each of the traffic periods discussed in paragraph 11.3.19.

Meteorological Data

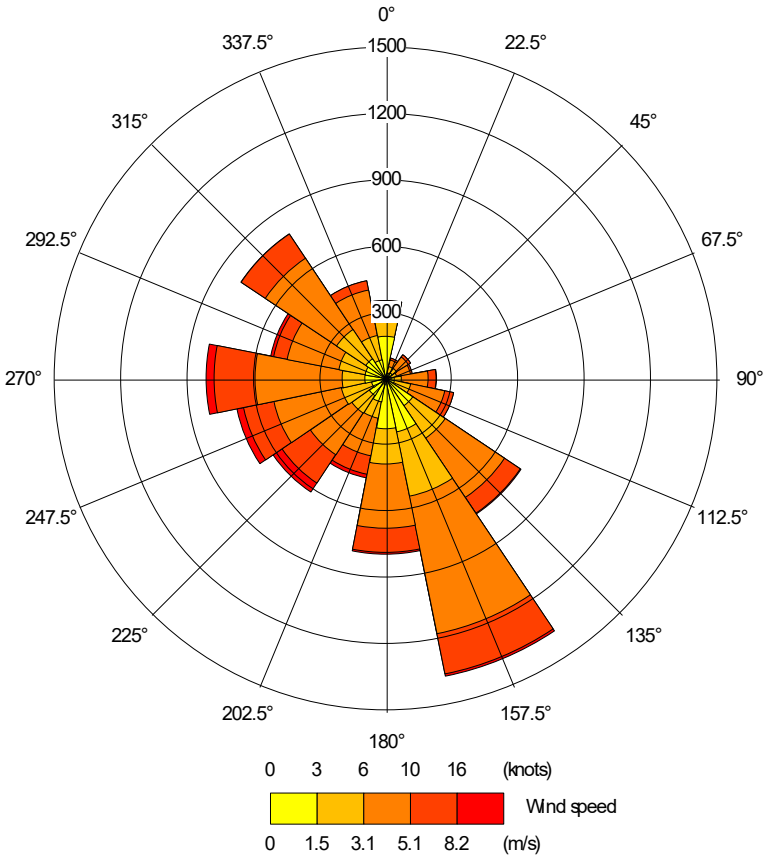
11.3.33 The most important meteorological parameters governing the atmospheric dispersion of emissions are wind direction, wind speed and atmospheric stability as described below:

- Wind direction determines the sector of the compass into which emissions are dispersed.
- Wind speed affects the distance which emissions travel over time and can affect dispersion by increasing the initial dilution of pollutants.
- Atmospheric stability is a measure of the turbulence of the air, and particularly of its vertical motion. It therefore affects the spread of the plume as it travels away from the source. ADMS uses a parameter known as the Monin-Obukhov length that, together with the wind speed, describes the stability of the atmosphere.

11.3.34 For meteorological data to be suitable for dispersion modelling purposes, a number of meteorological parameters need to be measured on an hourly basis. There are only a limited number of sites across the UK where the required meteorological measurements are made.

11.3.35 Data for 2023 from Hawarden meteorological station was used within the assessment, which is the closest station to the Scheme, approximately 3.8km to the south-east. The meteorological station is considered representative of the modelled study area due to its proximity to the Scheme and similar land use and topography. A wind rose is presented in Figure 11-1 below and highlights predominant wind directions from the south-east. There are lower occurrences of wind from other directions and these tend to be associated with lower wind speeds.

Figure 11-1 Wind rose for Hawarden (2023)



Source: Generated from data sourced from ADM Ltd (2024).

Human Health Receptors

11.3.36 The air quality objectives only apply in locations of relevant exposure as set out in Table 11-2. Using professional judgement, receptors were selected at locations likely to have the highest pollutant concentrations (such as closest to a road or junction) or anticipated to experience highest level of change (next to roads within the ARN with the largest change in the traffic screening criteria). A total of seven human health receptors were selected for the assessment, consisting of six residential properties and one school. The human health receptors were modelled at a height of 1.5m in accordance with best practice. Figure 11-1 (Air Quality Receptors) of the ES Figures shows the location of these receptors in relation to the ARN, whilst Table 11-3 below provides details on their locations.

Table 11-3 Air quality assessment human health receptors

Receptor ID	Receptor name	Receptor type	British National Grid coordinates		
			X	Y	Z
HH1	51 Dundas St	Residential	331977	368194	1.5
HH2	Riverside Caravan Park	Residential	332398	368458	1.5
HH3	1 Bridge Villas	Residential	332147	368623	1.5
HH4	3 Claremont Avenue	Residential	332410	368669	1.5
HH5	12 Claremont Avenue	Residential	332609	368798	1.5
HH6	Ferry Bank Farm	Residential	332828	368738	1.5
HH7	Sealand Primary School	School	332538	368925	1.5

Ecological Receptors

11.3.37 As per DMRB LA 105, designated ecological sites considered in the assessment include Ramsar sites, Special Protection Areas (SPAs), Special Areas of Conservation (SACs), Sites of Special Scientific Interest (SSSIs), local nature reserves (LNRs), local wildlife sites (LWS), nature improvement areas, ancient woodlands and veteran trees that have a boundary located within 200m of the ARN.

11.3.38 There are two sensitive designated sites within 200m of the operational phase ARN of the Scheme; the River Dee SSSI/ River Dee and Bala Lake SAC. These two sites overlap and extend along the River Dee up to approximately 2km to the north west of the ARN and approximately 7km to the south east. Figures 8.1 and 8.2 of the ES Figures present the location of these two sensitive designated sites.

11.3.39 During the operational phase, the Scheme would alter the A494 River Dee Bridge by moving it approximately 35m to the south-east. There are no changes in traffic composition (number of vehicles or speed) as the Scheme is a like for like replacement of the existing A494 River Dee Bridge. Therefore, the realignment of the A494 River Dee Bridge would only change the location of the existing emissions and resultant pollutant concentration and nitrogen deposition from the existing road and would not change the overall air quality impact on the designated habitats.

11.3.40 In the section of the River Dee SSSI/River Dee and Bala Lake SAC located within 200m of the ARN, there is broadleaved deciduous woodland and Atlantic upper-mid & mid- low salt marshes along the riverbanks. These two habitats are located adjacent to both the existing and realigned A494 River Dee Bridge, and as such the habitats likely to experience the greatest impact from air quality would not change. An initial walkover survey, including the intertidal area, was undertaken in March 2025, and shows the saltmarsh at the top of the riverbanks to be in good condition. However, the intertidal survey was not conducted at an optimal time of the year and the lower saltmarsh habitat was submerged and the condition is unknown. As such, further intertidal surveys conducted by a marine ecologist are taking place in August 2025 to fully assess the condition of the saltmarsh.

11.3.41 It should be noted that the condition of saltmarshes is affected by a variety of factors, such as sea level changes, sediment supply and climate, and as such it is challenging to determine the specific air quality impact on them. In addition, beneath the existing bridge structure, the saltmarshes are absent, with stone/concrete revetment being present on the eastern

bank of the River Dee which prevents the colonisation of any vegetation, and predominantly mud, sand and silt being present on the west bank. However, as described in Chapter 16 (Marine Environment) of the ES, the absence of saltmarsh under the existing bridge on the west bank is mainly due to the shading effect of the bridge and lack of sunlight, rather than due to air pollution.

11.3.42 The background nitrogen deposition at the broadleaved deciduous woodland is 32.5 kg N/ha/year and 18.1 kg N/ha/year for the salt marshes, which is higher than the minimum critical load of 10 kg N/ha/year[29] set for both habitat types. Therefore, the minimum nitrogen deposition critical load is already exceeded with the existing A494 River Dee Bridge in place, and so no new exceedances would be created at habitats with the A494 River Dee Bridge realignment.

11.3.43 As the realignment of the A494 River Dee Bridge is not expected to change the quantity of road traffic emissions or their impact on ecological receptors, but rather relocate these impacts approximately 40m south-east where habitat critical loads are the same and initial surveys find the saltmarsh in good condition, the air quality effects on designated habitats are considered insignificant and have not been assessed further in this chapter.

Model Outputs

11.3.44 The outputs from the dispersion modelling are the annual mean NOx and PM_{10} roads contribution (in $\mu g/m^3$) at the selected sensitive human health locations.

[29] Retrieved from: https://www.apis.ac.uk/

Post-processing of Results

NOx to NO_2 Relationship

11.3.45 Emission rates used within dispersion modelling are based on NOx to represent all nitrogen-oxygen species emitted in exhaust gases. The proportion of NO_2 is needed for comparison with the air quality objectives presented in Table 11-1.

11.3.46 In accordance with Defra TG22[18], modelled road-traffic NOx has been converted to annual mean NO_2 using the Defra 'NOx to NO_2' calculator[30], assuming traffic mix 'all other urban UK traffic'.

Model Verification

11.3.47 Base year air quality predictions have been used to verify the model by predicting NOx concentrations at air quality monitoring locations and comparing the prediction with the monitored concentration. A model verification year of 2023 has been used, given that this is the most recent year where FCC monitoring data is available. As such, Scheme-specific monitoring undertaken between June 2024 and December 2024 has been bias adjusted and annualised to the year 2023. Further detail on the Scheme-specific monitoring survey is presented in Appendix 11.A (Air Quality Monitoring Report) of the Air Quality ES Appendices, whilst further detail on the model verification is presented in Appendix 11.A (Air Quality Model Verification Report) of the Air Quality ES Appendices.

Gap Analysis

11.3.48 To ensure that the modelled roadside NO_2 concentrations are not too optimistic, and to account for uncertainties in predicted future roadside NO_2 concentrations, an additional scenario called the projected base year,

[30] Defra (2024) NOx to NO_2 Calculator, Version 9.1 [online] available at https://laqm.defra.gov.uk/air-quality/air-quality-assessment/nox-to-no2-calculator/

has been included in the air quality modelling, to enable a gap analysis to be completed as required by DMRB LA 105.

11.3.49 The gap analysis is the application of adjustment factors which take into consideration the assumed roadside rates of reduction in NOx and NO_2 by Defra's modelling tools compared to observed roadside monitoring trend i.e. the gap between the predicted reductions and those observed.

11.3.50 The projected base year scenario (using the base year traffic data) has been modelled using the opening year vehicle emission factors and opening year background concentrations. The final results for the opening year have then been adjusted accordingly, from the gap factors produced, to reflect the long-term trend profile. The National Highways Long-Term Gap Analysis Calculator v1.1 (LTTE6) has been used to produce the gap factor and adjust the opening year results.

Background Concentrations

11.3.51 Total air pollutant concentrations comprise a background and local component; both of which have to be independently considered for the air quality assessment. The background component is determined by regional, national and international emissions, and often represents a significant proportion of the total pollutant concentration. The local component is affected by emissions from sources such as roads and chimney stacks, which are less well mixed locally, and add to the background concentration.

11.3.52 Only road traffic emission sources have been explicitly included within the dispersion model. Non-road traffic related emission sources, such as industrial and domestic emissions, are included in Defra's background concentration maps and have been accounted for within the assessment by assigning appropriate 'background' concentrations to modelled receptor locations in accordance with Defra LAQM TG22[18].

11.3.53 A comparison between Defra backgrounds and monitored NOx concentrations has been undertaken for the three FCC and two Scheme-

specific sites considered to be in background locations in the vicinity of the Scheme. The results from this comparison are presented below in Table 11-4. These sites are representative of air quality conditions across the study area and are therefore appropriate for the comparison.

11.3.54 In 2023, Defra background concentrations are lower than the monitored background concentrations across the five monitoring sites. Small differences in absolute concentrations between the Defra backgrounds and the monitored data can result in concentrations being underpredicted at modelled receptors. Therefore, the Defra NOx and NO_2 background concentrations applied to this assessment have been uplifted by an average factor of 1.35 recorded for NO_2, to improve the agreement with measured concentrations at the monitoring sites and ensure that concentrations are not underpredicted.

11.3.55 Where this assessment's modelled road links cover the majority of a background one kilometre grid square, the 'in-grid' road sector emissions (ie 'motorway', 'trunk', 'primary' and/or 'minor' roads) have been removed from the background annual mean NOx and NO_2 concentration estimates using the Defra Sector Removal Tool Version v9.0. This process has been undertaken to avoid double counting of road traffic emissions, which have already been predicted from the detailed dispersion modelling undertaken for the Scheme. Where traffic data is available only for a limited number of road links (eg at the edge of the study area, or where 'minor' roads are not available), road emissions have not been removed from background concentrations as a conservative measure.

Table 11-4 Comparison of 2023 monitored background NO_2 concentrations and Defra background pollutant map data

Site ID	NO_2 concentration (µg/m^3)		
	Monitored	**Raw Defra background**	**Adjustment factor**
ADDC-029	13.8	12.9	1.07
ADDC-117	11.0	9.9	1.11
ADDC-102	8.2	7.1	1.16
D4	15.5	8.6	1.81
D6	16.0	9.4	1.70
D9	9.9	8.1	1.22
Average factor	1.35		

Note: Annual data capture is 82.4% for ADDC-029, ADDC-117 and ADDC-102, 50% for D4 and D6 and 41.7% for D9. Data has been annualised where annual data capture is below 75%. * ADDC-029 is noted as a 'rural' site, whilst ADDC-102 and ADDC-117 are noted as 'kerbside' sites, but were considered suitable for background adjustment due to there environmental setting.

Assessment of 1-hour NO_2 Concentrations

11.3.56 For all sensitive human health receptors assessed, annual mean concentrations of NO_2 have been presented. Defra's Technical Guidance TG22[18] indicates that the hourly NO_2 air quality objective of 200µg/m^3 (not to be exceeded more than 18 times per year) is unlikely to be exceeded at roadside locations where the annual mean concentration is less than 60µg/m^3. Following this guidance, the hourly objective is not considered further within this assessment if the annual modelled mean NO_2 concentrations are predicted to be less than 60µg/m^3.

Assessment of Daily PM_{10} Concentrations

11.3.57 The prediction of daily mean concentrations of PM_{10} is available as an output option within the ADMS-roads dispersion model for comparison against the short-term air quality objective. However, as the model output for annual mean concentrations is considered more accurate than the modelling of the daily mean, an empirical relationship has been used to

determine daily mean PM_{10} concentrations. In accordance with TG22[18] the following formula has been used:

- No. of 24-hour mean exceedances = -18.5 + 0.00145 x annual mean + (206 / annual mean)

11.3.58 Based on this formula, an annual mean PM_{10} concentration of 32µg/m^3 equates to 35 days at or above 50µg/m^3.

Assessment Criteria for Human Health Receptors

11.3.59 DMRB LA 105 provides advice for evaluating significant air quality effects at receptors. Receptors that have a reasonable risk of exceeding an air quality threshold have been assessed in both a DM and DS scenario.

11.3.60 In accordance with DMRB LA 105, a conclusion of no likely significant air quality effect for human health shall be recorded where the:

- outcomes of the air quality modelling for human health indicates that all concentrations are less than the air quality thresholds; and/or
- difference in concentrations is imperceptible ie less than or equal to 1% of the air quality threshold (i.e. 0.4µg/m^3 or less for annual mean NO_2)

11.3.61 Where changes in concentrations are greater than 1% of the air quality threshold at qualifying receptors, then each receptor shall be assigned to one of the six boxes in Table 2.91 of DMRB LA 105, presented below in Table 11-5.

Table 11-5 Information for judgement of significant air quality effects of a scheme

Magnitude of change in concentration	Number of receptors with:	
	Worsening of air quality objective already above objective or creation of a new exceedance	Improvement of an air quality objective already above objective or the removal of an existing exceedance
Large (>4µg/m^3)	1 to 10	1 to 10

Magnitude of change in concentration	Number of receptors with:	
	Worsening of air quality objective already above objective or creation of a new exceedance	Improvement of an air quality objective already above objective or the removal of an existing exceedance
Medium (>2µg/m^3 to 4µg/m^3)	10 to 30	10 to 30
Small (>0.4µg/m^3 to 2µg/m^3)	30 to 60	30 to 60

11.3.62 Table 11-5 presents guideline bands for assessing likely significant effects.

11.3.63 Where the total number of receptors is less than the lower guideline band for all of the magnitude of change categories, the Scheme is unlikely to trigger a significant air quality effect for human health. Where the total number of receptors is greater than the upper guideline band in any of the magnitude categories the Scheme shall trigger a significant air quality effect.

11.3.64 If the Scheme results in effects where the number of receptors falls between the lower and upper guideline bands for any of the magnitude of change criteria, the information in Table 11-5 will then be used along with the following key criteria to determine the overall evaluation of air quality significance:

- The absolute concentration at each receptor, for example is the modelled concentration 40µg/m^3.
- How many receptors are there in each of the magnitude of change criteria, for example does the Scheme create more worsening than improvements.
- The magnitude of change in concentration at each receptor, for example 0.6µg/m^3 vs 1.8µg/m^3.

Assessment of Compliance Risk

11.3.65 DMRB LA 105 provides guidance in relation to the assessment of the risk of the Scheme affecting reported compliance with the Air Quality Directive.

The approach is set out in Figure 2.79 of DMRB LA 105 and has been followed in this assessment. To undertake the compliance risk assessment the following information is required:

- Air quality modelled results
- Defra's PCM model outputs for the compliance road network
- Defra's zones and agglomeration maps

11.3.66 Defra uses the PCM model to report compliance with the Air Quality Directive (EU Directive 2008/50/EC). PCM projections are available for all years from 2018 to 2030 from the base year of 2018. In general, NO_2 concentrations decline into the future, mainly in response to cleaner vehicles and technologies, and actions in Defra's Air Quality Action Plan. The most recent PCM model was published in 2020.

11.3.67 To determine the study area for the compliance risk assessment, the air quality study area was compared to the compliance risk road network in the PCM model. A compliance risk assessment is then required where the two networks intersect, which then forms the basis for the assessment of compliance risk for an individual scheme. There is one road link from the PCM model (census ID 802030571) which intersects the Scheme's ARN (see Figure 11-7 (Compliance Risk Assessment).

11.3.68 The assessment shall conclude there is no risk to the UK's reported ability to comply with the limit values in the shortest timescale possible where:

- there are no modelled exceedances of the air quality thresholds for any PCM link; or
- there are modelled exceedances of the air quality thresholds for any PCM link, but the change in annual mean NO_2 concentrations between the do minimum and do something is less than or equal to +/-0.4µg/m^3
- the project does not materially impact on measures within local air quality or national plans for the achievement of compliance.

11.3.69 Given the nature of the Scheme, a like for like road realignment, it would not materially impact measures within local air quality or national plans for the achievement of compliance. However, given the historic exceedance

of the limit value along the A494 and the introduction of new qualifying features (footpaths), a compliance risk assessment has been undertaken.

11.4 Assessment Assumptions and Limitations

11.4.1 The assessment has been based on the Scheme description presented in Chapter 2 (The Project) of this ES and on the latest general arrangement drawing of the Scheme at the time this assessment was undertaken[31].

11.4.2 The air quality modelling predictions are based on the most reasonable assumptions and most robust and representative inputs in accordance with best practice guidance. However, there is an inherent level of uncertainty associated with the model predictions, including:

- Uncertainties with model input parameters such as surface roughness length (defined by land use) and minimum Monin-Obukhov length (used to calculate stability in the atmosphere)
- Uncertainties with traffic forecasts
- Uncertainties with vehicle emission predictions
- Uncertainties with background air quality data
- Uncertainties with recorded meteorological data
- Simplifications made within post processing of the data that represent atmospheric dispersion or chemical reactions

11.4.3 In order to best manage these uncertainties, the air quality assessment has been undertaken with model verification against the latest available monitoring data for 2023 (both Scheme-specific and local authority monitoring data). The verification has been undertaken in line with TG22[18] produced by Defra. The verification process is carried out by comparing modelled and monitored pollutant concentrations, refining the model inputs where possible and, if necessary, adjusting the model output to account for systematic bias. An adjustment factor derived for the model has then been applied to the NO_2 and PM_{10} modelling outputs for the base

[31] A494 River Dee Bridge Replacement Scheme, Developed Design, Highways General Arrangement. Drawing number: 395318-MMD-00-XX-DR-C-0002-P01.6.pdf

year of the Scheme (2023) and NO_2 modelling outputs for the projected base year and opening year of the Scheme (2029).

11.4.4 The assessment has been verified using local authority monitoring data for 2023 and the air quality measurements from the Scheme-specific monitoring survey that was completed in December 2024, which was then bias adjusted and annualised to 2023 (the latest year with bias adjustment factors).

11.4.5 Following the verification process for this Scheme, an overall Root Mean Square Error value of less than 10% is achieved, which is considered robust according to Defra TG22[18]. On this basis, the modelled results are considered appropriate to allow a robust professional judgement of significance to be determined. The model verification for this Scheme is presented in Appendix 11.A (Air Quality Model Verification Report) of the Air Quality ES Appendices.

11.4.6 The uncertainties associated with the model predictions for future years have also been addressed through applying LTTE6 gap analysis factors to uplift opening year modelled concentrations, as described in paragraphs 11.3.48 to 11.3.50 of this Chapter.

11.5 Study Area

Construction Phase

Construction Dust

11.5.1 During the construction phase there would potentially be dust generating activities, such as earth moving and demolition. The distances from the emission source at which significant construction dust effects are likely to occur are dependent on the extent and nature of mitigation measures, the prevailing wind conditions, rainfall and the presence of screening. However, in accordance with DMRB LA 105, effects from construction activities that generate dust are generally limited to within 200m of the construction site boundary.

11.5.2 Therefore, following the advice set out in DMRB LA 105, sensitive features within 200m of any construction activities and site compounds have been identified, as part of the construction dust assessment. A total of approximately 700 sensitive human receptors and two designated sites were identified. The construction phase study area for the Scheme is presented within Figure 11-3 (Air Quality Construction Dust Buffer) of the ES Figures and the construction dust assessment is presented in Section 11.9 of this Chapter.

Construction Traffic Management Measures

11.5.3 During the construction phase, the Scheme would introduce new emission sources in the form of traffic from construction vehicles and the implementation of traffic management measures.

11.5.4 Three traffic management scenarios are currently being considered, which are relevant to air quality considerations:

- Worst case scenario (CT1) – Full closure of the A494 River Dee Bridge for two years (2027 and 2028).
- Best case scenario, stage 1 (CT2) – Closure of the eastbound carriageway whilst westbound carriageway remains open. This is estimated to last one year (2027). A speed restriction of 30mph would also be in place along the westbound carriageway. Eastbound traffic would need to be diverted (expected to be via the A55 North Wales Expressway south of Chester).
- Best case scenario, stage 2 (CT3) – Eastbound carriageway reopened with traffic in contraflow and westbound carriageway closed. This is estimated to last one year (2028). A speed restriction of 30mph would also be in place along the eastbound carriageway.

11.5.5 The qualitative assessment of the potential impacts of the construction traffic management measures has focussed on the areas that will experience the highest pollutant concentrations and/or the greatest increases in traffic during the construction phase (and therefore the greatest changes in pollutant concentrations). These changes are the result of vehicle rerouting or the traffic management measures themselves e.g. speed limit reductions.

11.5.6 The study area for the construction traffic management measures, which is displayed in Figure 11-8, has therefore considered:

- The A494 River Dee Bridge, where the 30mph speed restriction will be implemented in the best-case scenario;
- B5441 Welsh Road/Station Road, as vehicles which would usually travel across the A494 River Dee Bridge are predicted to use this local road as an alternative route across the River Dee, to avoid construction works, increasing traffic flows on this road;
- A548 Chester Road/Flintshire Bridge/Weighbridge Road/Shotwick Road, Kelsterton Lane, A55 North Wales Expressway between Ewloe and Hoole Village and the M53 between Hoole Village and Stoak, as vehicles which would usually travel across the River Dee via the A494 River Dee Bridge are predicted to use these alternative routes to avoid construction works, increasing traffic flows on these roads; and
- A483 Wrexham Road/ Grosvenor Road. This is because vehicles that would travel across the River Dee via the A494 River Dee Bridge and then along A548 Sealand Road to travel to/from Chester city centre would instead travel along the A55 North Wales Expressway and then A483 Wrexham Road/Grosvenor Road to avoid construction works, increasing traffic flows on this route.

11.5.7 As identified in DMRB LA 105, these traffic management measures have the potential to affect air quality at human health receptors and designated sites within 200m of the management measures. The impact of the traffic management measures on sensitive receptors have been considered qualitatively in Section 11.9.

11.5.8 As a result of the increases in vehicles on the roads listed in paragraph 11.5.6, it is expected that there will be a reduction in vehicles on the A55 Northop, A494 Queensferry, A548 Sealand Road and M56 in between the A494 and M53. This reduction would decrease road traffic emissions at sensitive receptors within 200m of those locations and therefore have not been considered further in the assessment.

Operational Phase

11.5.9 During the operational phase, the Scheme would alter parts of the existing road network through the realignment of the A494 River Dee Bridge by

approximately 40m to the south-east. This would move emission sources closer to some receptors and further away from others in the vicinity of the Scheme.

11.5.10 There are not expected to be any change in traffic composition (number of vehicles or speed) as the Scheme is a like for like replacement of the existing A494 River Dee Bridge.

11.5.11 In accordance with paragraph 2.1 of DMRB LA 105 and as presented in paragraph 11.3.19, the following criteria have been applied to the DM and DS scenario traffic flows. These criteria have been used in order to identify which roads are likely to be affected by the Scheme (referred to as affected roads) to a degree that they require consideration within the air quality assessment.

11.5.12 The criteria are:

- AADT >=1,000; or
- HDV AADT >=200; or
- a change in speed band; or
- a change in carriageway alignment by >=5m

11.5.13 Following a review of the general arrangement drawing of the Scheme, the affected roads identified for the air quality assessment include the A494 River Dee Bridge and a section of the A494 approximately 230m to the north of the River Dee and approximately 300m to the south. These affected roads (the ARN) are all located within the reliability area of the traffic model and are presented in Figure 11-4 (Air Quality Affected Road Network) of the ES Figures. Modelled traffic data used for the ARN has been provided in Appendix 11.A (SATURN Traffic Data Report) of the Air Quality ES Appendices and presented in Figure 11-5 (Air Quality Summary of Traffic Data) of the Air Quality ES Figures.

11.5.14 The assessment has considered the effects at worst-case sensitive human health receptors (residential properties and a school), as presented in Figure 11-1 (Air Quality Receptors) of the ES Figures. Details

of the receptors modelled can be found in paragraph 11.3.36 of this Chapter. A total of 7 human health receptors located within 200m of the ARN have been selected, which were the receptors predicted to experience the highest NO_2 concentrations and greatest change in air quality.

11.5.15 Additional road links within 200m of affected roads have been included in the air quality dispersion model where their emissions contribute to total concentrations at identified receptors. These are presented in Figure 11-4 (Air Quality Affected Road Network) of the ES Figures, and this approach is consistent with DMRB LA 105.

11.6 Baseline Conditions

11.6.1 Information on air quality in the UK can be obtained from a variety of sources including local authorities, national network monitoring sites and other published sources. For this assessment, data has been obtained from FCC[32], FCC's neighbouring local authority CWCC[33], National Highways and Defra.

11.6.2 The most recent full year of monitoring data available for FCC and CWCC at the time of writing is for 2023. The monitoring data for the two of the years prior to this, 2020 and 2021, is unlikely to be representative of 'normal' conditions at the monitoring sites, due to the effects associated with the coronavirus (Covid-19) pandemic during those years when Wales was subject to periods of lockdowns and the influences this had on traffic. Therefore, this data is presented for reference only.

11.6.3 Local authority data for the years 2022 and 2023 however are expected to be representative of 'normal' conditions, as they are not considered to have been affected by the coronavirus (Covid-19) pandemic. Therefore

[32] North Wales Authorities (2024) North Wales Authorities Collaborative Project 2024 Air Quality Progress Report
[33] Cheshire West and Chester Council Air Quality Annual Status Report 2024

2022 and 2023 local authority data has been used to determine baseline conditions.

11.6.4 In addition to this, a Scheme-specific air quality monitoring survey was undertaken for six months between June 2024 and December 2024, which was bias adjusted and annualised to the year 2023 (the latest year with bias adjustment factors), has also been used to inform the baseline and to verify the detailed dispersion modelling assessment.

Local Air Quality Management

11.6.5 There are no AQMAs currently declared by FCC and there are no AQMAs elsewhere that are likely to be affected by the Scheme. The nearest AQMA is the Chester City Centre AQMA (No. 5) located approximately 7.5km east of the Scheme and operational phase ARN, declared for exceedances of the annual mean NO_2 objective (see Figure 11-2 (Air Quality Constraints) of the ES Figure.

11.6.6 Based on the traffic data provided, increases in AADT flows are likely to occur during the construction phase along the western boundary of the AQMA on A548 New Crane Street, as well as along the A483 Wrexham Road/ Grosvenor Road approximately 80m to the south of the AQMA. These changes are due to the road closures and diversions that are expected from the traffic management measures. The Scheme is not likely to cause a significant effect on air quality in the Chester City Centre AQMA (No.5) for the following reasons:

- The diversions would be temporary and not last for more than two years. Therefore, in accordance with DMRB LA 105 it is unlikely that the construction activities would constitute a significant air quality effect.
- Existing baseline pollutants concentrations are below the objectives, including within the AQMA, where the highest monitored NO_2 concentration in the vicinity of the ARN is 26µg/m^3 at diffusion tube ‘WG’ on Watergate Street.
- The highest increase in AADT flow on Watergate Street is 2,000. The greatest increase in AADT flows during the construction period is in construction scenario CT1, where an increase of 30,500 AADT is predicted

along the B5441 Welsh Road/Station Road. The increase in 30,500 AADT results in a predicted NO_2 increase of 9.8µg/m^3 as discussed in paragraph 11.9.7. As increases in AADT flows in the vicinity of the AQMA are much smaller than along the B5441 Welsh Road/Station Road, the change in NO_2 concentration within the AQMA caused by the Scheme would be much lower and exceedances of the annual mean NO_2 objective are unlikely to occur.

- Exceedances of the annual mean PM_{10} objective are also unlikely to occur given that PM_{10} emissions are an order of magnitude lower than NOx emissions.

Local Authority Monitoring

In the Vicinity of the Scheme

11.6.7 No automatic monitoring is undertaken by FCC.

11.6.8 FCC currently undertakes non-automatic (diffusion tube) monitoring at 59 sites to assess compliance with the annual mean NO_2 air quality objective. Of these sites, 13 are within approximately 1km of the Scheme, as shown in Figure 11-6. The monitoring results for these sites are presented in Table 11-6.

11.6.9 Over the past five years of monitoring, annual and hourly mean NO_2 concentrations at all sites have been well below the objectives. In 2023, the highest concentration was monitored at location ADDC-083, located on the A494 Aston Hill, where it was 25.8µg/m^3.

Table 11-6 NO_2 diffusion tube monitoring locations in 2023

Site ID	British National Grid coordinates		Site type	Data capture 2023	Annual Mean NO_2 Concentration ($\mu g/m^3$)				
	X	Y			2019	2020	2021	2022	2023
ADDC-008[a]	330793	367434	Kerbside	82.4	24.3	14.4	-	26.6	25.3
ADDC-023	331665	368029	Urban background	82.4	27.8	18.6	20.1	19.3	19.8
ADDC-034	333043	369053	Roadside	75.0	14.4	14.1	14.0	14.3	12.9
ADDC-037	332227	367726	Kerbside	67.3	16.6	14.3	18.5	18.3	14.3
ADDC-052	333731	369079	Kerbside	82.4	16.7	7.2	10.5	10.3	9.8
ADDC-070	331807	368271	Kerbside	82.4	17.6	18.7	17.6	17.3	16.6
ADDC-083[a]	330792	367434	Kerbside	82.4	24.3	14.4	-	26.0	25.8
ADDC-085	330716	367349	Kerbside	75.0	25.2	19.1	20.4	20.7	18.3
ADDC-099	330726	367354	Kerbside	82.4	13.9	17.7	19.0	18.5	21.6
ADDC-101[a]	330792	367434	Kerbside	82.4	24.3	14.4	27.3	24.3	24.8
ADDC-104	332558	368750	Kerbside	82.4	-	-	12.5	16.5	16.1
ADDC-116	332519	368899	Kerbside	75.0	22.1	14.6	14.7	15.5	15.2
ADDC-117	332500	367357	Kerbside	82.4	32.5	10.0	11.1	10.3	11.0

Source: Data has been obtained from the North Wales Authorities Collaborative Project 2024 Air Quality Progress Report.
Note: a) Sites ADDC-008, ADDC-083 and ADDC-101 are co-located with an automatic monitor operated locally by an external organisation. Data from this automatic monitoring site was inaccessible by FCC prior to 2023 and therefore for consistency, FCC has continued to apply the national bias adjustment factor of 0.77 to the 2023 FCC monitoring results, rather than a local factor.
b) Monitoring data with data capture <75% has been annualised.
'-' indicates no monitoring data available for corresponding year.

Wider Study Area

Automatic Monitoring

11.6.10 Automatic monitoring is undertaken in the wider study area by CWCC, which borders FCC. There are two automatic monitoring stations in Chester City Centre: CBI at Chester Bus Interchange which monitors NO_2 and PM_{10} and BO in Boughton which monitors NO_2. Both are located within Chester City Centre AQMA (No.5) and are not representative of air quality along the Scheme extents but have been presented to give context of NO_2 concentrations within a nearby AQMA.

11.6.11 Table 11-7 and Table 11-8 show that there were no exceedances of the 1-hour and annual mean NO_2 at automatic monitoring stations BO and CBI in any of the years between 2019 and 2023, or the 24-hour and annual mean PM_{10} objectives at automatic monitoring station CBI. This is despite both being located within Chester City Centre AQMA (No.5) and automatic monitoring station CBI being located at the Chester Bus Interchange, where emissions from buses are likely to be higher due to idling and the changes in speed e.g. accelerations, decelerations, stops and starts.

Table 11-7 NO_2 automatic monitoring locations in 2023

Site ID	British National Grid coordinates		Site type	Data capture 2023	Annual Mean NO_2 Concentration (µg/m^3) / Number of times hourly mean is greater than 200µg/m^3 (-)				
	X	Y			2019	2020	2021	2022	2023
BO	341864	366444	Roadside	67.4	23 (0)	17 (0)	19 (2)	18 (0)	15.5 (0)
CBI	340645	366802	Roadside	99.3	38 (0)	29 (0)	30 (0)	32 (0)	31.6 (2)

Source: Data has been obtained from the Cheshire West and Chester Council Air Quality Annual Status Report 2024.
Note: a Monitoring data with data capture <75% has been annualised.

Table 11-8 PM_{10} automatic monitoring location in 2023

Site ID	British National Grid coordinates		Site type	Data capture 2023	Annual Mean PM_{10} Concentration (µg/m^3) / Number of times daily mean is greater than 50µg/m^3 (-)				
	X	Y			2019	2020	2021	2022	2023
CBI	340645	366802	Roadside	95.3	21 (9)	23 (4)	22 (2)	20 (5)	18.3 (0)

Source: Data has been obtained from the Cheshire West and Chester Council Air Quality Annual Status Report 2024.
Note: a Monitoring data with data capture <75% has been annualised.

Diffusion Tube Monitoring

11.6.12 As mentioned in paragraph 11.5.5, the study area for the construction traffic management measures has focussed on the areas that will experience the highest pollutant concentrations and/or the greatest increases in traffic during the construction phase. In the wider study area, this includes the A548 Chester Road/Flintshire Bridge/Weighbridge Road/Shotwick Road, Kelsterton Lane, A55 North Wales Expressway between Ewloe and Hoole Village, the M53 between Hoole Village and Stoak and the A483 Wrexham Road/ Grosvenor Road. The diffusion tubes that have recorded the greatest NO_2 annual mean concentrations along/near these roads in 2023 are presented below in Table 11-9.

11.6.13 As shown in Table 11-9, annual mean NO_2 concentrations were below the objective of 40µg/m^3 between 2019 and 2023. The highest concentration recorded in 2023, the latest year with data available, is 26.0µg/m^3 at monitoring site WG located near the A483 Grosvenor Road. The locations of these monitoring sites are displayed in Figure 11-6.

Table 11-9 Local authority diffusion tube monitoring locations recording the highest annual mean NO_2 concentrations along/near the A548, A55, M53 and A483 in 2023

Road	Site ID	British National Grid coordinates		Site type	Data capture 2023	Annual Mean NO_2 Concentration ($\mu g/m^3$)				
		X	Y			2019	2020	2021	2022	2023
A548	ADDC-091	325961	371822	Kerbside	55.5	11.2	7.8	18.6	18.2	19.3
A55 and M53	ADDC-061	334739	363340	Kerbside	82.4	16.6	12.7	12.1	12.4	12.7
A483	WG	340217	366209	Roadside	90.6	35.2	27.3	25.4	27.0	26.0

Source: Data has been obtained from the North Wales Authorities Collaborative Project 2024 Air Quality Progress Report.
Note: a Bias adjustment factors of 0.77 and 0.81 have been applied to the 2023 FCC and CWCC monitoring results respectively.
b Monitoring data with data capture <75% has been annualised.
c Monitoring sites ADDC-091 and ADDC-061 are located within FCC's administrative area whilst monitoring site WG is in CWCC's. Monitoring site WG is located within Chester City Centre AQMA (No.5)

Scheme- specific Diffusion Tube Monitoring

11.6.14 A Scheme-specific diffusion tube monitoring survey was undertaken in 2024 to support the assessment. Monitoring was undertaken at 9 locations along the Scheme alignment and surrounding areas. The monitoring survey commenced in June 2024 and was completed in December 2024. Further detail on the monitoring survey is presented in Appendix 11.A (Air Quality Monitoring Report) of the Air Quality ES Appendices.

11.6.15 The results from the 2024 survey were bias adjusted and annualised to the year 2023 (the latest year with bias adjustment factors) in accordance with Defra's LAQM TG(22)[18]. The results from this survey are presented below in Table 11-10.

11.6.16 There were no exceedances of the NO_2 annual mean air quality objective, with all concentrations below 40µg/m^3. The greatest annual mean NO_2 concentration of 28.4µg/m^3 was monitored at site D5, located approximately 3m from the kerbside of the A494.

11.6.17 The locations of the Scheme-specific monitoring sites are presented in Figure 11-6 (Air Quality Monitoring Locations) of the ES Figures.

Table 11-10 Scheme-specific NO_2 diffusion tube monitoring data

Site ID	British National Grid coordinates		Site type	Survey period data capture (%)	2023 annual mean concentration (µg/m^3)
	X	Y			
D1	330793	367433	Roadside	100	25.6
D2	331944	368152	Roadside	100	25.9
D3	331968	368178	Roadside	100	25.5
D4	331937	368206	Urban background	100	15.5
D5	332278	368489	Roadside	100	28.4
D6	332277	368452	Urban background	100	16.0
D7	332403	368651	Roadside	100	14.4
D8	332837	368774	Roadside	100	11.6
D9	333173	368646	Urban background	83.3	9.9

Note: Results have been bias adjusted and annualised.
(a) A national bias adjustment factor of 0.83 has been applied to the results to correct the diffusion tube measurements. b As defined in Defra's TG22, a roadside site is "A site sampling typically within 1-5m of the kerb of a busy road". An urban background site is an "An urban location distanced from sources and therefore broadly representative of city-wide background conditions, e.g. urban residential areas".

Defra Projected Background Concentrations

11.6.18 Defra provides mapped future year projections of background pollution concentrations for NO_X, NO_2, PM_{10} and $PM_{2.5}$ for each 1km grid square across the UK for all years between 2021 to 2040[34]. The maps include a breakdown of background concentrations by emission source, including road and industrial sources, which have been calibrated against 2021 (the baseline year) UK monitoring data. The maximum adjusted concentrations across the grid square containing the Scheme area are presented below in Table 11-11 for the base year of 2023. There are no exceedances of air quality objectives.

Table 11-11 Maximum adjusted 2023 Defra background concentrations across the grid cells containing the modelled human health receptors

Year	Pollutant			
	NOx	**NO_2**	**PM_{10}**	**$PM_{2.5}$**
2023	14.2	11.0	12.3	6.8

Source: Defra (2021)
Note: The background concentrations shown are for the following 1 kilometre squares: X 331500 Y 368500 for NOx and NO_2 and X 332500 Y 368500 for PM_{10} and $PM_{2.5}$.
As detailed in paragraph 11.3.54, the Defra NOx and NO_2 background concentrations have been uplifted by an average factor of 1.35 for NO_2, to improve the agreement with measured concentrations at background monitoring sites in the vicinity of the Scheme and ensure that concentrations are not underpredicted.

Limit Value Compliance

11.6.19 Defra uses the Pollution Climate Mapping (PCM) model to report compliance with limit values as transposed into UK Law from Directive 2008/50/EC109[1]. PCM projections are available for all years from 2018 to 2030 from the base year of 2018. The most recent PCM model was published in 2020.

11.6.20 Based on projected roadside NO_2 concentrations in the current version of the PCM model, there are no PCM links in the vicinity of the Scheme that exceed the annual mean limit value of 40µg/m^3 for the base year of 2023 or opening year of 2029. There is one PCM link that intersects the Scheme boundary and ARN (PCM link model ID 802030571), as shown in

[34] Defra Background maps (2021) Available at: https://uk-air.defra.gov.uk/data/laqm-background-maps

Figure 11-7. This link has predicted annual mean NO_2 concentrations of 34.8µg/m^3 and 24.4µg/m^3 in 2023 and 2029 respectively which are below the limit value of 40µg/m^3.

Summary

11.6.21 There are no AQMAs currently declared by FCC or any that are likely to be affected by the Scheme.

11.6.22 The local authority and Scheme-specific monitoring data for the area shows no exceedances of air quality objectives. The Defra predictions also indicate that background concentrations at the Scheme do not exceed the relevant air quality objectives for all relevant pollutants.

11.6.23 Ambient pollutant concentrations of NO_2, PM_{10} and $PM_{2.5}$ are generally predicted to decrease into the future, due to the uptake of cleaner vehicles and technologies; as such it is considered that air quality conditions in the vicinity of the Scheme are likely to improve and continue to meet the air quality objectives in future years.

11.7 Mitigation Measures Forming Part of the Scheme Design

Construction

11.7.1 Mitigation measures of relevance during construction are included within the CEMP. Construction works would be carried out in accordance with the best practicable means, as described in Section 7(1)(d) of the EPA 1990, to reduce fumes or emissions which may impact upon air quality. As a minimum, the following measures are secured to prevent significant adverse effects during the construction phase:

- Avoid double handling of materials.
- Minimise height of stockpiles and profile to minimise wind-blown dust emissions and risk of pile collapse.
- Locate stockpiles out of the wind (or cover, seed or fence) to minimise the potential for dust generation.

- Ensure that all vehicles with open loads of potential dusty materials are securely sheeted or enclosed.
- Provide a means of removing mud and other debris from wheels and chassis of vehicles leaving the site. This may involve a simple coarse gravel running surface or jet wash, or in the case of a heavily used exit point, wheel washers.
- Maintain a low speed limit on site to prevent the generation of dust by fast moving vehicles.
- Damp down surfaces in dry conditions.
- Water to be sprayed during cutting/grinding operations.
- All vehicle engines and plant motors to be switched off when not in use.
- High dust generating activities within site compounds should be located as far away from nearby receptors as possible.

Operation

11.7.2 No operational phase measures have been identified for air quality as part of the Scheme's design.

11.8 Assessment of Land Take Effects

11.8.1 No air quality effects are anticipated from land take associated with the Scheme, therefore this has not been assessed.

11.9 Assessment of Construction Effects

Assessment of Construction Dust

11.9.1 During the construction phase there would potentially be dust generating activities, such as earth moving and demolition, within 200m of the construction site boundary. A construction dust assessment has therefore been undertaken in line with Table 2.58a and Table 2.58b of DMRB LA 105 in order to determine the construction dust risk potential of the Scheme to the receiving environment. This will subsequently be used to inform the measures required to support the mitigation required.

11.9.2 In accordance with Table 2.58a of DMRB LA 105, the construction dust risk potential of the Scheme is classified as 'Small', due to the Scheme being a 'short highway project'.

11.9.3 The receiving environment sensitivity has been determined by identifying all sensitive human health receptors and designated habitats within 0-50m, 50-100m and 100-200m of the construction activity and site compounds, as presented in Table 11-12 below.

11.9.4 Mitigation measures presented in paragraph 11.7.1 of this Chapter have been selected based on the 'Small' construction dust risk potential and the proximity of the human health and ecological receptors to the Scheme. The implementation of these mitigation measures would minimise construction dust effects so that they are unlikely to result in significant effects at nearby receptors.

Table 11-12 Receiving environment sensitivity to construction dust

Receptor type	Distance from construction activities		
	0-50m	50-100m	100-200m
Human health	151	194	339
Ecological sites	2	0	0

* Note - the ecological receptors have been included to the closest bands in which they fall, as they are present in all three bands.

Assessment of Construction Traffic

11.9.5 The assessment of construction phase effects has focused on the traffic management measures associated with the Scheme including diversions and speed reductions.

Diversions

11.9.6 The traffic management measures detailed in Section 11.5 are predicted to lead to increases in AADT and HDV flows on the B5441 Welsh Road/Station Road, A548 Chester Road/Flintshire Bridge/Weighbridge Road/Shotwick Road, Kelsterton Lane, A55 North Wales Expressway

between Ewloe and Hoole Village, the M53 between Hoole Village and Stoak, and the A483 Wrexham Road/ Grosvenor Road. The increases in AADT flows would be expected to last for up to two years and as such any impacts on air quality at sensitive human health and ecological receptors within 200m of the roads would be temporary.

11.9.7 The greatest increases in AADT and HDV AADT flows along the roads listed above are presented below in Table 11-13, as well as the maximum annual mean NO_2 concentrations recorded at monitoring sites in 2023 (the latest year with monitoring data) and predicted on PCM links in 2027 (the first year of construction) in the vicinity of those roads. The greatest increase in AADT overall is 30,500 on the B5441 Welsh Road/Station Road during construction scenario CT1. Based on the DMRB LA 105 'air quality spreadsheet model'[35], this increase in traffic is equivalent to an increase in annual mean NO_2 concentration of 9.8µg/m^3, from 12.8µg/m^3 without construction to 22.6µg/m^3 with construction, which is well below the NO_2 air quality objective of 40µg/m^3.

[35] The DMRB LA 105 'air quality spreadsheet model' calculates concentrations of pollutants at individual receptors based on the proximity of the receptors to roads and the traffic flows on these roads (total flows, type of vehicles (i.e. LDV/HDV) and speeds). The inputs include:

- Traffic data and emission factors for the year 2027
- Traffic data for B5441 Welsh Road (DM scenario: AADT of 5860 (0 HDV) and free flow speed band, DS scenario: AADT of 36408 (0 HDV), light congestion speed band)
- Traffic data for the A494 River Dee Bridge (DM scenario: AADT of 71841 (8.18% HDV) and high-speed speed band, DS scenario: AADT of 0 due to the bridge closure).
- Distance of 6.2m from nearest receptor to centre of B5441 Welsh Road and 175m to centre of A494 River Dee Bridge.
- Road widths of 6.8m and 18.8m for B5441 Welsh Road and A494 River Dee Bridge respectively.
- Adjustment factor of 1.5

Table 11-13 Greatest increases in construction traffic flows on diverted roads and maximum annual mean NO_2 concentrations monitored and predicted in the vicinity of those roads

Location	Greatest increase in construction traffic flow			Annual mean NO_2 concentration ($\mu g/m^3$)	
	Scenario CT1 (Full closure 2027-2028)	Scenario CT2 (Eastbound closure 2027)	Scenario CT3 (Westbound closure 2028)	Ambient monitoring	PCM link
B5441 Welsh Road/Station Road	AADT: 30,500 HDV: 0	AADT: 21,300 HDV: 0	AADT: 16,500 HDV: 0	An annual mean NO_2 concentration of 16.6µg/m^3 was monitored in 2023 at diffusion tube ADDC-070 located on the B5441 Station Road	An annual mean NO_2 concentration of 27.2µg/m^3 was predicted in 2027 on the PCM link on the A494 River Dee Bridge (census ID 80203057), approximately 150m to the south east of the B5441 Welsh Road/Station Road
A548 Chester Road/Flintshire Bridge/Weighbridge	AADT: up to 18,400	AADT: up to 10,500 HDV: 1,700	AADT: 6,200 HDV: 300	An annual mean NO_2 concentration of 19.3µg/m^3 was monitored in 2023 at	An annual mean NO_2 concentration of 23.4µg/m^3 was predicted in 2027 on

Road/Shotwick Road and Kelsterton Lane	HDV: 2,900			diffusion tube ADDC-091 located on the A548 Chester Road	the PCM link on the A550 Welsh Road (census ID 802030625), approximately 85m to the south east of the A548 Shotwick Road
A55 North Wales Expressway between Ewloe and Hoole Village and the M53 between Hoole Village and Stoak	AADT: 13,400 HDV: 1,900	AADT: 7,000 HDV: 800	AADT: 5,800 HDV: 60	An annual mean NO_2 concentration of 12.7µg/m^3 was monitored in 2023 at diffusion tube ADDC-061 which is located on Centenary Close in Broughton approximately 15m to the north of the A55 North Wales Expressway	An annual mean NO_2 concentration of 15.1µg/m^3 was predicted in 2027 on the PCM link on the A41 Whitchurch Road (census ID 801077792), which intersects the A55 North Wales Expressway near Christleton
A483 Wrexham Road/ Grosvenor Road	AADT: 2,400 HDV: 100	AADT: 1,300 HDV: 40	AADT: 1,500 HDV: 10	An annual mean NO_2 concentration of 26.0µg/m^3 was monitored in 2023 at diffusion tube WG which is located on the A548 Watergate Street within the Chester City Centre AQMA (No.5), approximately 370m	An annual mean NO_2 concentration of 18.9µg/m^3 was predicted in 2027 on the PCM link on the A5268 Saint Martin's Way (census ID 801038228) located within the Chester City Centre AQMA (No.5)

				from the A483 Grosvenor Road	

* Note: AADT and HDVs flows are two-way and have been rounded.

11.9.8 In addition to the monitoring data presented in Table 11-13 above, the automatic monitoring station CBI which is located in the centre of Chester within Chester City Centre AQMA (No.5) recorded an annual mean PM_{10} concentration of 18.3µg/m^3 in 2023, which is well below the objective of 40 µg/m^3.

11.9.9 Based on the duration of the construction phase and the monitored NO_2 and PM_{10} concentrations in the vicinity of the diversion routes, it is unlikely that the increase in emissions of NOx and PM_{10} associated with the Scheme's diversion routes would lead to an exceedance of the NO_2 and PM_{10} air quality objective of 40µg/m^3 or constitute a significant effect. In addition, the predicted annual mean NO_2 concentrations on the PCM links in the vicinity of the diversion routes are also well below the limit value of 40µg/m^3 which indicates that the construction of the Scheme would not affect the UK's reported ability to comply with the Air Quality Directive (2008), as transposed into UK law, in the shortest timescales possible.

Speed Limit Reduction

11.9.10 A temporary speed reduction from 50 miles per hour to 30 miles per hour is proposed on the A494 River Dee Bridge in the best-case scenarios (CT2 and CT3). The traffic data provided indicates that as a result of these speed limits, vehicles would generally travel at a 'free flow' speed with no construction taking place, compared to at a 'light congestion' speed with construction taking place. Within 200m of the A494 River Dee Bridge, there are residential receptors and the River Dee SSSI/ River Dee and Bala Lake SAC.

11.9.11 AADT flows are expected to be much lower along the A494 River Dee Bridge during the CT2 and CT3 construction scenarios due to diversions and speed limit reductions encouraging road users to find alternative routes. With no construction taking place, the total two-way AADT flow would be approximately 71,800, compared to approximately 28,500 in the CT2 scenario (no-contraflow, A494 open to westbound traffic only) and 40,300 in the CT3 scenario (contraflow in place, traffic flow in both directions).

11.9.12 The increased emissions associated with reducing the speed limit from 50mph (free flow) to 30mph (light congestion) would be more than offset by the reduction in emissions associated with the reduced traffic flow, as indicated in Table 11-14 below.

Table 11-14 Change in mass emissions associated with speed limit reductions on the A494 River Dee Bridge

	2027 Emission Factor (g/km)		2027 AADT flows without and with construction			Mass emissions (g/km) for each scenario using AADT flows		
	FF	LC	Without construction	Construction scenario CT2	Construction scenario CT3	Without construction – FF	Construction scenario CT2 – LC	Construction scenario CT3 – LC
LDV	0.13	0.16	65965	25757	35136	8575.5	4121.1	5621.8
HDV	0.35	0.7	5876	2755	5201	2056.6	1928.5	3640.7
Mass emissions by scenario						10632.1	6049.6	9262.5

Note: 'FF' refers to free flow and 'LC' refers to light congestion.
Mass emissions for each scenario have been calculated by multiplying the mass emissions and AADT flows together.
The distance travelled between the without and with construction is the same and for the purpose of these calculation a distance of 1km has been assumed.

11.9.13 Existing pollutant concentrations are also low, with the maximum annual mean NO_2 concentration recorded in 2023 being 28.4µg/m^3 at diffusion tube D5, located along the A494.

11.9.14 Overall, the temporary speed reduction would not have a significant effect on air quality as monitored annual mean NO_2 concentrations are well below the air quality objective and road traffic emissions are expected to decrease on the A494 River Dee Bridge during the construction phase.

Significance of Air Quality Effects Associated with Traffic Management

11.9.15 Overall, the impacts associated with the traffic management measures which would be implemented during the construction phase are not expected to result in significant air quality effects. This is because:

- The diversions would be temporary and not last for more than two years. Increases in AADT flows in the wider area would also occur where annual mean NO_2 and PM_{10} concentrations do not exceed the relevant air quality objectives. It is unlikely that the temporary increase in emissions of NOx and PM_{10} associated with the Scheme's diversion routes would lead to an exceedance of the relevant air quality objectives or constitute a significant effect.
- An increase in vehicle emissions caused by speed limit reductions on the A494 River Dee Bridge would be more than offset by reduction in traffic flows. Roadside pollutant concentrations are likely to decrease in the vicinity of the A494 River Dee Bridge during the construction phase.
- Since the changes in traffic flow and emissions from diversion routes and speed limit reductions occur on different roads, there would be no combined impact from both measures.

11.10 Assessment of Operational Effects

11.10.1 The operational phase of the Scheme has the potential to directly affect air quality at human health receptors (residential properties and a school). The Scheme would change the road layout and alignment which has the potential to both increase and decrease the distance between vehicle emissions and receptors.

11.10.2 There are not expected to be any change in traffic composition (number of vehicles or speed) as the Scheme is a like for like replacement of the existing A494 River Dee Bridge.

Human Health

11.10.3 Total NO_2 concentrations were predicted for the base year, projected base year and the opening year DM and DS scenarios. The total concentrations of NO_2 predicted in the base and opening year scenarios are presented in Table 5-12. The locations of the receptors are presented in Figure 11-1 (Air Quality Receptors) of the ES Figures.

11.10.4 The Scheme is predicted to cause both increases and decreases in NO_2 concentrations at modelled receptors due to changes in the distance between receptors and the A494 River Dee Bridge.

11.10.5 Annual mean NO_2 concentrations are well below 40µg/m^3 in both the DM and DS scenarios at all modelled receptors.

11.10.6 The maximum annual mean NO_2 concentration of 23.7µg/m^3 is predicted at residential receptor HH1 in the DS scenario. This receptor is located on Dundas Street, approximately 7.5m north west of the A494. It has the highest modelled concentrations in the DS due its proximity to the A494 and the predominant wind direction being from the south-east (see paragraph 11.3.35), which transport air pollutants from the A494 towards the receptor.

11.10.7 The greatest increase in annual mean NO_2 concentrations in the opening year is predicted at residential receptor HH2 located at Riverside Caravan Park. At this location there is predicted to be an increase in annual mean NO_2 concentrations of 0.4µg/m^3 from 11.9µg/m^3 in the DM to 12.3µg/m^3 in the DS scenario. This change is ‘imperceptible’ (less than or equal to 0.4µg/m^3) in accordance with DMRB LA 105 (see paragraph 11.3.60). The increase is caused by the A494 River Dee Bridge alignment (and therefore the emission source) being closer to receptor HH2 in the DS scenario than it is in the DM scenario. In the DM scenario, receptor HH2 is

approximately 110m from the carriageway, compared to approximately 70m in the DS scenario. In both the DM and DS scenarios the total annual mean NO_2 concentrations are well below the air quality objective of 40µg/m^3.

11.10.8 The greatest improvement in annual NO_2 concentrations in the opening year is predicted at residential receptor HH4, located on Claremont Avenue to the north west of the A494 River Dee Bridge. At this receptor, it is predicted that there will be a decrease in annual NO_2 concentrations of 2µg/m^3 between the DM and DS scenarios. This is due to the bridge alignment being closer to the receptor in the DM scenario than DS scenario. In the DM scenario, the receptor is approximately 30m from the A494 carriageway, compared to approximately 65m in the DS scenario.

11.10.9 In accordance with Defra's TG22[18], as all predicted annual mean concentrations on NO_2 are well below 60µg/m^3, no exceedances of the 1-hour NO_2 objective are predicted.

Table 11-15 Air quality assessment results at human receptors for NO_2 (µg/m^3) in Base, DM and DS scenario

Receptor ID	Base year (2023)		Opening year (2029)			
	Background	Total	Background	DM Total	DS total	Change
HH1	11.0	25.2	9.0	23.7	23.7	<0.1
HH2	10.7	12.8	9.0	11.9	12.3	0.4
HH3	10.7	13.0	9.0	12.1	12.0	-0.1
HH4	10.7	17.4	9.0	16.3	14.3	-2.0
HH5	10.7	15.8	9.0	14.8	14.5	-0.3
HH6	10.7	13.4	9.0	12.4	12.5	0.1
HH7	10.7	13.1	9.0	12.2	12.2	<0.1

Note: '<' means 'less than'; '-' represents a decrease in concentration

Compliance Risk Assessment

11.10.10 A compliance risk assessment was undertaken in line with DMRB LA 105 (paragraph 2.64 to 2.87). Receptor points located 4m from the edge of roads included in the PCM model and at relevant qualifying features were included in the air quality dispersion model, and are displayed in Figure 11-7.

11.10.11 As mentioned in paragraph 11.6.20, there is one PCM link on the A494 that intersects with the Scheme's ARN (PCM link model ID 802030571). The annual mean NO_2 concentration predicted by Defra at this link has been compared against the average concentration predicted by the Scheme's dispersion model at the receptor points located 4m from the edge of the A494. Table 11-16 and Table 11-17 present the comparison between the concentrations in the base year of 2023 and opening year of 2029.

11.10.12 The difference between the two modelled concentrations at the 4m point is greater than 10% for both base and opening year. However, as detailed in paragraph 11.3.47, base year air quality predictions have been used to verify the model against local air quality monitoring data. Following the verification process, an overall Root Mean Square Error value of less than 10% was achieved, which is considered robust according to Defra TG22[18]. In addition, the modelled base year results are similar to monitored 2023 concentrations along the existing A494, as shown in Table 11-16. On this basis, the modelled results are considered appropriate to allow a robust professional judgement of significance to be determined. Therefore, the results from the Scheme's model have been used to inform compliance risk assessment, in accordance with paragraph 2.77 of DMRB LA 105.

11.10.13 In addition, annual mean NO_2 concentrations have been predicted at four qualifying feature receptor locations along the PCM link on the A494. Qualifying features include public access (such as a footpath) or sensitive receptors (e.g. residential properties, schools, hospitals) within 15m of the

edge of the running lane (excludes the hard shoulder) / kerbside, and outside of 25m of a junction) and are presented in Table 11-18.

11.10.14 One of the qualifying features is at a residential property on Dundas Street adjacent to the existing A494 River Dee Bridge, whilst the other three are at footpaths adjacent to the realigned A494 River Dee Bridge. All concentrations are well below the annual mean NO_2 limit value of 40µg/m^3, with the highest being 16.6µg/m^3 at Receptor QF3 which is at a footpath approximately 2.5 metres to the south east of the realigned bridge, to the north west of the Riverside Caravan Park.

Table 11-16 Local model 4 metre point validation – Base year

PCM link census ID	Road	Monitored 2023 annual mean NO_2 concentration ($\mu g/m^3$) and distance from existing A494 road			Modelled 2023 annual mean NO_2 roadside concentration ($\mu g/m^3$)		% difference (local model vs PCM model)
		D2 (5.5m)	D3 (7m)	D5 (2.5m)	PCM model	Local model (average)	
802030571	A494	25.9	25.5	28.4	34.8	26.0	25.3

Table 11-17 Local model 4 metre point validation – Opening year

PCM link census ID	Road	Modelled 2029 annual mean NO_2 roadside concentration ($\mu g/m^3$)		% difference (Scheme model vs PCM model)
		PCM model	Local model (average)	
802030571	A494	24.4	16.7	31.4

Table 11-18 Assessment of compliance risk

Qualifying feature	Receptor type	Modelled 2029 annual mean NO_2 concentration ($\mu g/m^3$)		Change ($\mu g/m^3$)
		DM	DS	
QF1	Residential property	16.2	16.2	<0.1

Qualifying feature	Receptor type	Modelled 2029 annual mean NO_2 concentration ($\mu g/m^3$)		Change ($\mu g/m^3$)
		DM	DS	
QF2	Footpath (new)	n/a	15.7	n/a
QF3	Footpath (new)	n/a	16.6	n/a
QF4	Footpath (new)	n/a	16.4	n/a

Note: Arithmetic discrepancies occur due to rounding of results. Only DS results are available for the new footpaths being created along the realigned A494 River Dee Bridge.

Significance of Air Quality Effects

Human Health

11.10.15 Table 11-19 presents the number of properties within each magnitude of change category for the Scheme.

11.10.16 As discussed in paragraph 11.10.5, there are no modelled receptors with a predicted annual mean NO_2 concentration above the relevant air quality objective in either of the opening year (2029) DM or DS scenarios.

Table 11-19 Number of properties above the annual mean NO_2 objective with a change in air quality

Magnitude of change in annual mean (µg/m^3)	**Number of receptors with:**	
	Worsening of an air quality objective already above objective or creation of a new exceedance	**Improvement of an air quality objective already above objective or the removal of an existing exceedance**
Large (>4µg/m^3)	0	0
Medium (>2µg/m^3 to 4µg/m^3)	0	0
Small (>0.4µg/m^3 to 2µg/m^3)	0	0

Compliance Risk Assessment

11.10.17 As discussed in paragraph 11.10.14, there are no qualifying feature receptor locations predicted to experience exceedances of the annual mean NO_2 limit value in the DS scenario in the opening year (2029) of the Scheme. The concentrations are below the annual mean limit value of 40µg/m^3 for NO_2 and are expected to continue reducing in the future. This demonstrates that the Scheme would not affect the UK's reported ability to

comply with the Air Quality Directive[1], as transposed into UK law, in the shortest timescales possible.

Summary

11.10.18 Overall, it is concluded that there are no likely significant air quality effects. This is due to there being no adverse small, medium or large impacts where an air quality objective is already exceeded or where an exceedance is created as a result of the Scheme. The highest annual mean NO_2 concentration is 23.7µg/m^3 in the DS scenario, which is well below the objective. The compliance risk assessment undertaken has demonstrated that the Scheme also does not affect the UK's reported ability to comply with the Air Quality Directive, as transposed into UK law, in the shortest timescales possible.

11.11 Additional Mitigation and Monitoring

11.11.1 No significant adverse effects are anticipated as a result of the Scheme, therefore additional air quality mitigation or monitoring is not required.

11.12 Assessment of Cumulative Effects

11.12.1 The effects of the A494 River Dee Bridge Scheme have been assessed in-combination to demonstrate that this will not lead to significant effects. As discussed in paragraph 11.3.25, the opening year traffic data for 2029 used in the assessment includes the Scheme and other committed developments along with future traffic growth. The maximum modelled annual mean NO_2 DS concentration of 23.7µg/m^3, predicted at receptor HH1, is below the annual mean NO_2 objective and therefore the effects are predicted to be not significant.

11.12.2 2.. The traffic data provided for the air quality dispersion modelling has excluded the A55/A494/A548 Flintshire Corridor scheme, as the scheme was withdrawn in 2023 following advice from the Welsh Government's Roads Review Panel. The Panel stated that the scheme would increase private car capacity and result in a mode shift from public transport to car

travel, and this would undermine the target to increase sustainable transport mode share. Therefore the scheme has not been classified as a committed scheme.

Inter-relationships

Nature conservation

11.12.3 There is an inter-relationship between the air quality and nature conservation assessments for the Scheme. Changes in air quality have the potential to impact on sensitive ecological receptors through dust deposition. Risks from construction dust deposition will be mitigated through the CEMP. Effects are not predicted to be significant.

Noise

11.12.4 There is an inter-relationship between the air quality and noise assessments for the Scheme. Construction may expose receptors close to the works to both construction dust and noise emissions from construction activities. Effects are not predicted to be significant with the application of the mitigation measures in the CEMP.

Human Health

11.12.5 There is an inter-relationship between the air quality and human health assessments for the Scheme. The air quality assessment results have been used to inform the likely effects on human health as a result of the Scheme in Chapter 14 (Population and Human Health).

Climate change

11.12.6 There is an inter-relationship between air quality and climate change; changes in temperature and rainfall can have a direct effect on dispersion of emissions from sources. However, as the construction of the Project will be undertaken in the near future and the Scheme will not change traffic composition and therefore the quantity of emissions, it is unlikely that

climate change would contribute significantly to the air quality effects predicted from the Scheme.

11.13 Summary of Residual Effects

11.13.1 A qualitative assessment of potential dust effects for the Scheme has been undertaken, based on a review of likely dust raising activities and identification of sensitive receptors within 200m of the study area. Potential dust impacts would be suitably controlled using the best practice mitigation measures set out within the CEMP.

11.13.2 A qualitative assessment of the impacts associated with the construction traffic management measures has also been undertaken and concluded that, due to the temporary nature of the measures and low existing pollutant concentrations, there are not expected to be significant air quality effects at nearby receptors during the construction phase.

11.13.3 An assessment has been undertaken to assess the air quality impact during the operation of the Scheme at human health receptors, using an atmospheric dispersion model. The model has been verified against air quality monitoring data and has been used to estimate the air quality impacts of changes in traffic associated with the Scheme.

11.13.4 Concentrations across human health receptors are expected to be well below the NO_2, PM_{10} and $PM_{2.5}$ air quality objectives. The predicted effects from the operation of the Scheme on air quality at human health receptors are therefore concluded to be not significant, so no mitigation measures are proposed. The Scheme also does not affect the UK's reported ability to comply with the Air Quality Directive in the shortest timescales possible.

11.13.5 The impact of the operation of the Scheme at designated habitats has also been considered. It has been concluded that the realignment of the A494 River Dee Bridge would not change the overall air quality impact on designated habitats. The A494 River Dee Bridge is not expected to change the quantity of road traffic emissions or their impact on ecological receptors, but rather relocate these impacts approximately 40m south-

east where habitat critical loads are the same. Therefore, it has been concluded that the changes caused by the Scheme are not significant.

11.13.6 Considering the results presented in this assessment, the Scheme is consistent with national and local planning policy with respect to air quality.

Llywodraeth Cymru / Welsh Government

A494 RIVER DEE BRIDGE REPLACEMENT SCHEME

Environmental Statement

Volume 1: Technical Assessment Report

Chapter 12: Noise and Vibration

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12. Noise and Vibration

12.1 Introduction

12.1.1 This chapter presents an assessment of noise and vibration as a result of the A494 River Dee Bridge Improvement Scheme (hereafter referred to as 'the Scheme').

12.1.2 The Scheme has the potential to give rise to both temporary and permanent noise and vibration impacts that could affect nearby sensitive receptors adjacent to the Scheme and along nearby road links. Consequently, these impacts may generate effects, adverse or beneficial, at sensitive receptors.

12.1.3 The noise and vibration assessment follows the methodology set out in the Scoping Report for the Scheme, submitted in December 2024.

12.1.4 In accordance with the Note to paragraph 1.4 of the Design Manual for Roads and Bridges (DMRB) LA111 operational vibration is scoped out of the assessment. This is because, "*a maintained road surface will be free of irregularities as part of project design and under general maintenance, so operational vibration will not have the potential to lead to significant adverse effects*."

12.1.5 An approach to defining significance of effect for construction noise and vibration has now been incorporated within DMRB and has been applied to this assessment.

12.1.6 Relocation of the Queensferry surface water pumping station is necessary due to displacement of the current facility by the proposed new westbound carriageway. The pumping station will be designed and constructed to achieve noise limits agreed with Flintshire County Council (FCC). The pumping station will not therefore generate noise impacts resulting in a significant adverse effect, and is therefore scoped out of the assessment reported in this chapter. An assessment of the potential noise impacts of the pumping station is however presented in Volume 3 Appendix 12-C of this ES for reference.

12.2 Legislation and Policy Framework

Legislation

Control of Pollution Act 1974

12.2.1 The Control of Pollution Act 1974[1] requires that 'Best Practicable Means' (as defined in Section 72) are adopted to control construction noise on any given site. It makes reference to advice within BS 5228 as comprising best practicable means. BS 5228 is an adopted code of practice under the Act.

12.2.2 Sections 60 and 61 of the Act provide the main consideration regarding demolition and construction site noise and vibration. If noise complaints are received, a Section 60 notice may be issued by the Local Authority with instructions to cease work until specific conditions to reduce noise have been adopted. Section 61 provides a means for applying for prior consent to carry out noise generating activities during construction. Once prior consent has been agreed under Section 61, a Section 60 notice cannot be served provided the agreed conditions are maintained on-site.

12.2.3 Applications to the Local Authority under Section 61 are the responsibility of the contractor undertaking the works and are made once construction methodology; plant inventories and programme are known in detail.

The Noise Insulation Regulations 1975 (SI 1975/1763), as amended by the Noise Insulation (Amendment) Regulations 1988 (SI 1988/2000)

12.2.4 The Noise Insulation Regulations 1975[2] (amended 1988[3]) were made under Part 2 of the Land Compensation Act for the obligatory and discretionary provision of noise insulation measures for dwellings adjacent to new or altered highways.

[1] CROWN, 1974. Control of Pollution Act 1974
[2] CROWN, 1975. Building and Buildings The Noise Insulation Regulations 1975
[3] CROWN, 1988. The Noise Insulation (Amendment) Regulations 1988

Eligibility for noise insulation occurs where living rooms or bedrooms have a façade with windows or doors exposed to an increase in noise level of at least 1.0 dB attributed to the Scheme and where the "relevant noise level" resultant from the Scheme, together with other traffic noise in the vicinity, is at or above the "specified noise level" of $L_{A10,18hour}$ 68 dB. The Regulations set out the process by which offers of noise insulation measures are made and what those measures should be.

The Environmental Noise Regulations

12.2.5 The Environmental Noise (Wales) Regulations 2006[4] as amended by the Environmental Noise (Wales) (Amendment) Regulations 2009[5] are collectively referred to as the Environmental Noise Regulations.

12.2.6 Under the Regulations, Welsh Ministers have an obligation to produce and keep updated noise maps for:

- agglomerations (large urban areas with populations of over 100,000);
- major roads (roads with over three million vehicles passing each year); and
- major roads (roads with over three million vehicles passing each year); and

Well-being of Future Generations (Wales) Act 2015

12.2.7 The Act[6] has a number of well-being goals to achieve through implementing sustainable development. Changes in noise levels can have an impact on the health of habitats and humans, as such the goals to create 'a resilient Wales' and 'a healthier Wales' are applicable.

National Planning Policy

Planning Policy Wales Edition 12 – February 2024

[4] WELSH GOVERNMENT, 2006. The Environmental Noise (Wales) Regulations 2006
[5] WELSH GOVERNMENT, 2009. The Environmental Noise (Wales) (Amendment) Regulations 2009
[6] WELSH GOVERNMENT, 2015. Well-being of Future Generations (Wales) Act 2015

12.2.8 Planning Policy Wales[7] describes the planning development policies of the Welsh Assembly Government. Section 6.7 considers Air Quality and Soundscape. Paragraph 6.7.4 states that "*The planning system should maximise its contribution to achieving the well-being goals, and in particular a healthier Wales, by aiming to reduce average population exposure to air and noise pollution alongside action to tackle high pollution hotspots. In doing so, it should consider the long term effects of current and predicted levels of air and noise pollution on individuals, society and the environment and identify and pursue any opportunities to reduce, or at least, minimise population exposure to air and noise pollution, and improve soundscapes, where it is practical and feasible to do so.*"

Paragraph 6.7.16 states that "*Relevant considerations in making planning decisions for potentially polluting development are likely to include:*

…the risk and impact of potential pollution from the development, insofar as this might lead to the creation of, or worsen the situation in, an air quality management area, a noise action planning priority area or an area where there are sensitive receptors"

Technical Advice Note (TAN) 11: Noise

12.2.9 TAN 11[8] provides technical guidance on noise-generating development including transportation projects.

Noise and Soundscape Action Plan 2023 – 2028

12.2.10 The Noise and Soundscape Action Plan (NSAP) 2023-2028[9] presents a single consolidated noise action plan for Wales, as required by the Environmental Noise Regulations.

12.2.11 Section 1.1 of the document states the following practice should be followed when undertaking activities that may affect soundscapes in Wales:

[7] WELSH GOVERNMENT, 2024. Planning policy Wales (Edition 12, February 2024)
[8] WELSH GOVERNMENT, 1997. Technical Advice Note (TAN) 11: Noise
[9] WELSH GOVERNMENT, 2023, Noise and Soundscape Action Plan 2023-2028

"*Pursuing long-term, sustainable solutions to instances of high public noise exposure or poor soundscape quality, while developing policies in other areas in such a way as to consider their potential long-term consequences (whether positive or negative) for soundscapes in Wales.*"

12.2.12 Section 3.1 of the document states:

"*Planning policy in relation to… noise and soundscape emphasises the requirement to secure opportunities as part of the planning process, rather than just avoid the worst negative impacts. It is no longer acceptable to regard… noise merely as technical matters to be mitigated at the end of the process. Rather, they are integral to the design, functioning, health, amenity and well-being of places. Accordingly, an integrated approach should be taken towards drawing up strategies and formulating proposals for places, including those relating to… soundscape.*"

Local Planning Policy

12.2.13 FCC adopted the Local Development Plan (LDP) for the County on 24 January 2023. The LDP covers 2015 to 2030, and is used as the basis to make decisions on planning applications and development proposals. The LDP includes the following policies relevant to Noise and Vibration which have informed the assessment:

*"**STR14: Climate Change and Environmental Protection***

The Council will seek to mitigate the effects of climate change and ensure appropriate environmental protection in the County through:

vi. \ ensuring that new development has regard to the protection of the environment in terms of… noise…"

"***PC2: General Requirements for Development***
All development should:
b. not have a significant adverse impact on the safety and living conditions of nearby residents, other users of nearby land/property, or the community in

general, through increased activity, disturbance, noise, dust, vibration, hazard, or the adverse effects of pollution"

"***PC3: Design***

All development should:

h. protect the living conditions of nearby occupiers from any harmful effects of new development including overlooking, harm to outlook, increased activity/disturbance/noise."

"***EN 18: Pollution and Nuisance***
New development which would create an increased risk of noise, vibration, odour, dust, light or other pollution or hazard will only be permitted if:
a. it would not unacceptably harm general amenity or living conditions; and
b. it would not impose significant restrictions on the use or development of surrounding land."

12.2.14 The proposed scheme is approximately 2km away from the boundary with Cheshire West and Chester Council (CWaC). This is beyond the study area boundary as defined in Section 12.3.

12.2.15 The effects of traffic displacement during operation, in comparison with the 'Do Minimum' scenario, has been considered and this consideration extended to roads within CWaC.

Guidance

12.2.16 The guidance documents which provide the methodology used in the assessment of construction and operational noise and vibration impacts and effects, or otherwise inform consideration of significance of such effects, are introduced in this section. Guidance relating to the assessment of construction noise and vibration is set out first, followed by guidance relevant to the assessment of operational noise and vibration.

BS 5228 Code of practice for noise and vibration control on construction and open sites – Part 1: Noise

12.2.17 BS 5228-1[10] provides a methodology for predicting and assessing noise levels generated by fixed and mobile plant used for a range of typical construction operations. The standard includes a database of noise levels at a reference distance of 10m from the source and a simple noise propagation model that can be used to make allowance for effects such as source-receiver distances, ground properties and utilisation time.

BS 5228 Code of practice for noise and vibration control on construction and open sites – Part 2: Vibration

12.2.18 BS 5228-2[11] provides guidance on the effect of vibration, and the likelihood it will cause complaint and cosmetic damage to buildings and gives recommendations for methods of vibration control. Vibration levels are predicted in terms of peak particle velocity (PPV).

TRL Research Report 53, Ground vibration caused by civil engineering works

12.2.19 Transport Research Laboratory (TRL) has published the results of a series of measurements of vibration levels at distances from a range of construction works[12]. The ground conditions in the area of the source and receiver position, and of the intervening ground, are not specified in the report, however it is considered to be sufficiently robust for the purposes of this assessment.

Design Manual for Roads and Bridges (DMRB), LA111 Noise and Vibration Revision 2, 2020[13]

12.2.20 Provides guidance on the assessment of impacts from noise and vibration that may result from road projects. The guidance is used in this assessment to

[10] BSI, 2009, amended 2014. British Standard (BS) 5228 Code of practice for noise and vibration control on construction and open sites – Part 1: Noise
[11] BSI, 2009, amended 2014. British Standard (BS) 5228 Code of practice for noise and vibration control on construction and open sites – Part 2: Vibration.
[12] Transport Research Laboratory, 1986. Ground vibration caused by civil engineering works (Research Report 53).
[13] Highways England, Design Manual for Roads and Bridges, LA111Noise and Vibration ((Revision 2), 2020

determine a methodology for assessing noise from the construction and operational phases of the Scheme.

Calculation of Road Traffic Noise

12.2.21 Calculation of Road Traffic Noise (CRTN)[14] provides procedures for predicting noise levels for a given flow of road traffic at sensitive receptors. These methodologies are used in the determination of entitlement under the Noise Insulation Regulations and for traffic noise change assessments undertaken in accordance with the DMRB guidance noted above.

12.2.22 CRTN methodology divides the road scheme up into segments and a basic noise level (BNL) at a reference distance of 10m from the nearside edge of the carriageway is predicted for each segment based upon traffic flow and speed. Based upon the BNL for each segment, a noise level is taken at each noise sensitive receptor receiving noise from that segment, taking into account highway gradient, distance attenuation and screening from structures or landscape features. Further corrections are made from site layout features including reflections from buildings. The contributions from all segments are combined to predict the noise level at the receptor from the Scheme as a whole.

Historic England – Piling and Archaeology

12.2.23 Historic England's[15] guidance on Piling and Archaeology outlines best practice for managing the potential impacts of piling on archaeological remains and historic structures. It provides a framework for assessing risk, selecting appropriate piling techniques, and implementing mitigation strategies where necessary. This guidance has been considered in the assessment of construction-related vibration effects on heritage assets.

[14] DEPARTMENT OF TRANSPORT, 1988. Calculation of Road Traffic Noise.
[15] Historic England, 2019. Piling and Archaeology: Guidance and Good Practice. Swindon: England: Available at: https://historicengland.org.uk/images-books/publications/piling-and-archaeology/heag270-piling-and-archaeology/ [Accessed 16 Jun 2025].

BS 7385 Evaluation and measurement for vibration in buildings – Part 1: Guide for measurement of vibrations and evaluation of their effects on buildings

12.2.24 BS 7385-1[16] outlines general principles for measuring and evaluating building vibrations, with a focus on structural response. It provides guidance on instrumentation, data processing, and interpretation of results, particularly where vibration may affect structural integrity, serviceability, or the preservation of historic buildings. This standard has informed the approach to the vibration assessment.

Consultation

12.2.25 A meeting was held on 19 March 2019 with a member of FCC's Public Protection team to discuss the preliminary outcomes of the air quality and noise assessment. No concerns were raised with respect to noise and vibration assessment methodologies and outcomes. The Environmental Health Officer (EHO) indicated that, in the case of construction at the Chester to Holyhead railway line, 24 hour working was likely to be acceptable subject to suitable advance notice for residents and clear duration of works. The EHO indicated that a Section 61 application could be used to confirm this. The possession of the railway for construction works, however, is no longer anticipated.

12.2.26 Further consultation was undertaken with the EHO in December 2021 with regard to the assessment of noise from the relocated Queensferry surface water pumping station. The assessment was found to be acceptable and the EHO (Mr Jones) supported the proposal to redesign and relocate the facility.

12.2.27 An updated scoping report was submitted in December 2024. A response was received in January 2025 from Natural Resources Wales (NRW), which advised that underwater noise from construction and demolition work (e.g. percussive piling) on bridge piles/supports or caissons should be included in the list of potential construction impacts. Assessment of the impact of underwater noise on fisheries has been undertaken and is reported in the Marine Ecology Chapter 16

[16] British Standards Institution (1990) BS 7385-1:1990 Evaluation and measurement for vibration in buildings – Part 1: Guide for measurement of vibrations and evaluation of their effects on buildings. London: BSI.

of the ES. The assessment of underwater noise did not identify any significant residual effects on the marine environment.

12.3 Assessment Methodology

12.3.1 The assessment method followed the procedures for operational noise and for construction noise and vibration as set out in DMRB LA 111 Noise and Vibration.

Construction Noise and Vibration

Study Area for Construction Noise and Vibration

12.3.2 A construction noise study area of 300m from the closest construction activity has been selected in line with the recommendations of Paragraph 3.5 of DMRB LA 111.

12.3.3 For the evaluation of construction traffic noise, the study area is defined as 50m from the kerb of public roads with the potential for an increase in basic noise level (BNL) of 1 dB or greater expressed as $L_{A10,18hours}$ as a result of construction traffic.

12.3.4 A construction vibration study area of 100m from the closest construction activity has been selected in line with the recommendations of Paragraph 3.29 of DMRB LA 111.

Construction Noise

12.3.5 Methodology and plant noise data set out in the appendices of BS 5228-1 have been used to predict construction noise levels at noise sensitive receptors based upon indicative plant inventories. Plant inventories and details of the construction noise predictions are presented in Volume 3 Appendix 12-B Construction Noise Assessment.

12.3.6 Table 3.12 of DMRB LA 111 sets out the approach to defining LOAEL and SOAEL for construction noise and is reproduced in Table 12-1 below.

Table 12-1 LOAEL and SOAEL for Construction Noise

Time period	LOAEL	SOAEL
Daytime (07:00 – 19:00) Saturdays (07:00 – 13:00)	Baseline noise levels ($L_{Aeq,T}$)	Threshold level determined as per BS 5228-1 Section E3.2 and Table E.1 BS 5228-1
Night-time (23:00 – 07:00)	Baseline noise levels ($L_{Aeq,T}$)	Threshold level determined as per BS 5228-1 Section E3.2 and Table E.1 BS 5228-1
Other: Weekday evenings (19:00 – 23:00) Saturdays (13:00 – 23:00) Sundays (07:00 – 23:00)	Baseline noise levels ($L_{Aeq,T}$)	Threshold level determined as per BS 5228-1 Section E3.2 and Table E.1 BS 5228-1

Source: Based on Table 3.12 of DMRB LA111

12.3.7 DMRB LA 111 makes reference to section E.3.2 of BS 5228-1 when defining SOAEL. Under this approach, the adverse effect threshold is determined at a receptor using the existing ambient noise level, rounded to the nearest 5 dB. This is then used to determine the assessment category: A, B or C, which then defines the adverse noise effect threshold.

12.3.8 The ABC method thresholds for the different periods of the day / week are reproduced in Table 12-2.

Table 12-2 Threshold of potential significant effects at noise sensitive receptors

Assessment category and threshold value period	Threshold values in decibels (dB), ($L_{Aeq,T}$)		
	Category A	Category B	Category C
Night-time (23:00 – 07:00)	45	50	55
Daytime (07:00 – 19:00) Saturdays (07:00 – 13:00)	65	70	75
Other: Weekday evenings (19:00 – 23:00) Saturdays (13:00 – 23:00) Sundays (07:00 – 23:00)	55	60	65

Source: Based on Table 3.12 of DMRB LA 111

- The Category A threshold is used when the ambient noise level is less than the Category A value given in Table 12-2;
- The Category B threshold is used when the ambient noise level is the same as the category A value;
- The Category C threshold is used when the ambient noise level is higher than the Category A value.

12.3.9 DMRB LA 111 provides a hierarchy of the magnitude of construction noise impacts. This is reproduced in Table 12-3.

Table 12-3 Magnitude of impact for construction noise

Magnitude of impact	Construction noise level
Major	Above or equal to SOAEL +5dB
Moderate	Above or equal to SOAEL and below SOAEL +5dB
Minor	Above or equal to LOAEL and below SOAEL
Negligible	Below LOAEL

Source: Based on Table 3.16 of DMRB LA 111

Construction Traffic Noise

12.3.10 Construction traffic has the potential to create noise disturbance. DMRB LA 111 provides a hierarchy of the magnitude of construction traffic noise impacts based upon predicted noise change. This is reproduced in Table 12-4.

Table 12-4 Magnitude of construction traffic impacts

Magnitude of impact	Increase in BNL of closest public road used for construction traffic (dB)
Major	Greater than or equal to 5.0
Moderate	Greater than or equal to 3.0 and less than 5.0
Minor	Greater than or equal to 1.0 and less than 3.0
Negligible	Less than 1.0

Source: Based on Table 3.17 of DMRB LA 111

This assessment reported in this chapter considers the likely transport routes and presents a qualitative discussion of construction traffic impacts.

Construction Vibration

12.3.11 The threshold of vibration perception in residential environments is identified at an exposure level of 0.3mm/s PPV in accordance with guidance in BS 5228: Part 2. Complaint is likely where levels occur above 1.0mm/s PPV at residential properties but this exposure can be tolerated if prior warning and explanation has been given to residents. Above a level of 10mm/s PPV the vibration is likely to be intolerable for any more than a very brief exposure to this level. DMRB LA 111 defines LOAEL for construction vibration as a peak particle velocity (PPV) of 0.3mm/s, and SOAEL as a PPV of 1.0mm/s.

12.3.12 DMRB LA 111 provides a hierarchy of the magnitude of construction vibration impacts. This is reproduced in Table 12-5.

Table 12-5 Magnitude of construction vibration impacts

Magnitude	Vibration level
Major	Above or equal to 10 mm/s PPV
Moderate	Above or equal to SOAEL and below 10 mm/s PPV
Minor	Above or equal to LOAEL and below SOAEL
Negligible	Below LOAEL

Source: Based on Table 3.33 of DMRB LA 111

12.3.13 In addition, BS 5228-1:2009+A1:2014 provides the guidance on effect of construction vibration of increasing magnitude. This has been reproduced in Table 12-6 and has been used for the construction vibration assessment.

Table 12-6 Criteria for construction vibration (annoyance)

Vibration level	Effect
0.14 mm/s	Vibration might be just perceptible in the most sensitive situations for most vibration frequencies associated with construction. At lower frequencies, people are less sensitive to vibration.
0.3 mm/s	Vibration might be just perceptible in residential environment
1.0 mm/s	It is likely that vibration of this level in residential environments will cause complaint but can be tolerated if prior warning and explanation has been given to residents.
10 mm/s	Vibration is likely to be intolerable for any more than a very brief exposure to this level in most building environments.

Source: Based on Table B.1 of BS5228-2:2009+A1:2014

12.3.14 Table B.2 of the BS 5228-2:2009+A1:2014 further introduces magnitudes of vibration which may cause cosmetic damage to residential or light commercial buildings. These are reproduced in Table 12-7.

Table 12-7 Criteria for construction vibration (building damage)

Type of building	PPV in frequency range of predominant pulse	
	4 Hz – 15 Hz	**15 Hz and above**
Unreinforced or light framed structures Residential or light commercial buildings	15 mm/s at 4 Hz increasing to 20 mm/s at 15 Hz	20 mm/s at 15 Hz increasing to 50 mm/s at 40 Hz and above

Source: Table B2 of BS 5228-2:2009+A1:2014

Vibration damage to heritage structures

12.3.15 Several cultural heritage assets have been identified within the construction vibration study area, notably the Aston Quay Building, Queensferry Shipyard II, Aston Quay; port, Queensferry Landing Stage II, Aston Railway, and Aston Quay Landing Stage IV III and V. Consequently, an assessment has been undertaken to determine whether the construction of the Scheme will generate vibration levels that approach the thresholds for potential damage to the cultural heritage assets. For more details on designated heritage assets, refer to Chapter 10 (Archaeology and Cultural Heritage).

12.3.16 BS 7385-1 notes that: "*A building of historical value should not (unless it is structurally unsound) be assumed to be more sensitive."* However, it is evident that none of the limits given in Table 12-7 specifically relate to heritage or particularly sensitive structures. For those structures that do not fall within the category specified in Table 12-7, the guidance presented in Table 2 of the Historic England - Piling and Archaeology document has been used to determine the levels of permissible vibration exposure to the heritage structures in proximity to vibratory construction works associated with the Scheme. It has been determined that all heritage structures in proximity to these works fall within category I specified in Table 12-8, therefore the threshold of significance for damage to heritage structures is 2 mm/s. An equivalent document has not been published for Wales; therefore, the Historic England document has been utilised.

Table 12-8 Permissible peak particle velocity for different structures

Category	Type of structure	Permissible PPV (mm/s)
I	Ruins and damaged buildings, protected as monuments	2
II	Buildings with visible defects, cracks in masonry	4
III	Undamaged buildings in technically good condition	8
IV	Well-stiffened buildings (i.e. industrial)	10 – 40

Source: Historic England. Piling and Archaeology

Operational Noise

Study Area for Operational Noise

12.3.17 The study areas for the assessment of permanent changes in road traffic noise during operation is defined with due consideration of Note 1 of paragraph 3.44 of DMRB LA 111.

12.3.18 LA 111 recommends that the study area comprises the area within 600m of the A494 where this is physically changed by the Scheme, and the area within 50m of other road links with the potential to experience a short term change in BNL of > 1.0 dB(A) due to implementation of the Scheme.

12.3.19 In this assessment, the study area includes an area 600m from the scheme and bypassed routes. Additional areas have also been included within 1km of the scheme extents to account for receptors near to road links which are potentially affected due to changes in traffic as a result of the scheme (i.e. road links which include an increase or decrease in noise levels due to the scheme by at least 1 dB in the opening year). The study area includes all areas surrounding the scheme where there is a reasonable expectation that a noise assessment is undertaken.

12.3.20 Volume 2 Figure 12.1 shows the study area which has been determined using the current design layout for the Scheme and the analysis of forecast traffic data.

Operational Noise

12.3.21 The DMRB LA 111 approach to assessing noise impact is to compare the noise levels for the Do Something (with Scheme) scenario against noise levels for the Do Minimum (without Scheme) scenario. The method requires that comparisons are made between the baseline noise situation (before the change produced by the scheme) and the noise level in both the scheme Opening Year and the Worst-Case Year in the first fifteen years after opening (generally the 15th year after opening).

12.3.22 DMRB LA 111 requires that a night-time noise assessment is carried out. The L_{night} descriptor is used to represent the noise level at dwellings between the hours of 23:00 and 07:00. The L_{night} values were derived using TRL PR/SE/451/02 Method 3[17] in accordance with DMRB LA 111.

12.3.23 Noise predictions have been carried out according to the CRTN methodology and Appendix A of DMRB LA 111 using DataKustik CadnaA software, version 2025. Traffic noise levels have been calculated across a grid of receiver positions and contours of noise level exposure have been established.

12.3.24 Appendix A of DMRB LA111 guidance provides simplified correction values low noise surfaces (LNS). The correction values are speed dependent. Guidance advises LNS offer a reduction in noise compared to hot rolled asphalt (HRA) for speeds greater than 75 km/h. In practice some noise reduction properties are expected to occur for traffic speeds less than but approaching 75 km/h. On this basis the LNS (i.e. Stone Mastic Asphalt (SMA)) is expected to provide a small noise benefit and assist in reduce potential adverse noise impacts at receptors. However, this noise reduction has not been quantified in the noise model. Road

[17] Transport Research Laboratory, 2014. P G Abbott and P M Nelson. TRL PR/SE/451/02, 'Converting the UK traffic noise index LA10,18h to EU noise indices for noise mapping'

links with SMA surfaces can be seen on the Pavement, Kerbings and Footways drawings (395318-MMD-00-XX-DR-C-0701 to 395318-MMD-00-XX-DR-C-0704).

12.3.25 Noise levels are calculated in terms of the $L_{A10,18hour}$ index as specified in CRTN. This represents the A-weighted noise level exceeded for 10% of the time between the hours of 06:00 and 00:00 on an average weekday. The traffic flow predictions on which the noise calculations are made have been taken from the traffic impact assessment data for the different scenarios.

12.3.26 In DMRB LA 111, different scales are applied for assigning magnitude of impact for short and long term impacts due to changes in road traffic. These are presented in Table 12-9 and can be positive or negative.

Table 12-9 Classification of magnitude of short and long-term noise impacts due to changes in road traffic noise

Magnitude of impact	**Noise Change, $L_{A10,18hour}$**	
	Short term	Long term
No change	0	0
Negligible	0.1 to 0.9	0.1 to 2.9
Minor	1.0 to 2.9	3.0 to 4.9
Moderate	3.0 to 4.9	5.0 to 9.9
Major	5.0+	10.0+

Source: DMRB LA 111

12.3.27 Table 3.49.1 of DMRB LA 111 sets out the approach to defining LOAEL and SOAEL for operational noise and is reproduced in Table 12-10.

Table 12-10 Operational noise LOAEL and SOAEL

Time period	**LOAEL**	**SOAEL**
Daytime (06:00-24:00)	55dB $L_{A10,18hr}$ facade*	68dB $L_{A10,18hr}$ facade
Night-time (23:00 – 07:00)	40dB $L_{night,outside}$ free-field**	55dB $L_{night,outside}$ free-field

Source: DMRB LA 111 Table 3.49

* Façade denotes the noise level is determined at 1m from a façade

** Free-field denotes the noise level is determined at a location at lease 3.5m from building facades or other acoustically reflective elements

Determination of Significance

12.3.28 The following summarises the criteria for significance discussed in the preceding sections. These criteria are consistent with those set out in DMRB LA 111.

Construction Noise

12.3.29 Where evaluation of the predicted construction noise level results in a major or moderate adverse impact as defined in Table 12-3; and the duration of the impact exceeds either; 10 or more days or nights in any 15 consecutive days or nights; or more than 40 days in any six consecutive months, a significant adverse effect occurs.

12.3.30 The exception to this is where there is a high baseline noise level equal to or greater than SOAEL. In this situation the total noise from baseline and construction combined must result in an increase of at least 3 dB above the existing baseline for there to be the potential for a significant adverse effect.

Construction Traffic Noise

12.3.31 Where evaluation of the predicted construction traffic noise level results in a major or moderate adverse impact as defined in Table 12-4; and the duration of the impact exceeds either; 10 or more days or nights in any 15 consecutive days or nights; or more than 40 days in any six consecutive months, a significant adverse effect occurs.

Construction Vibration

12.3.32 Where evaluation of the predicted construction vibration at residential receptors results in a major or moderate adverse impact as defined in Table 12-5; and the duration of the impact exceeds either; 10 or more days or nights in any 15

consecutive days or nights; or more than 40 days in any six consecutive months, a significant adverse effect occurs.

Operational Noise

12.3.33 The determination of significance of effect for traffic noise takes into account both the magnitude of noise change and the exceedance of SOAEL.

12.3.34 Initial assessment of significance for operational noise is based on the short-term impact defined as noise change set out DMRB LA 111 Table 3.58, reproduced above in Table 12-9. This initial assessment considers that changes classified as a moderate or major impact are likely to result in a significant effect.

12.3.35 Table 3.60 of DMRB LA 111 presents further guidance on local circumstances which are considered in the final determination of significance. These include:

- Absolute noise level with reference to LOAEL and SOAEL;
- Location of the noise sensitive parts of a given receptor;
- Acoustic context; and
- Likely perception of change by residents.

12.3.36 In this assessment, moderate and major noise impacts at residential receptors are considered to result in a significant effect, and, where the absolute noise level in the do something condition is above SOAEL, a noise change of 1.0dB or more in the short term is considered to result in a significant effect.

12.4 Baseline Conditions

Noise and Vibration Sensitive Receptors

12.4.1 The Study Area for the Scheme comprises a mix of suburban, rural and commercial / industrial areas. The A494 is the primary source of noise for receptors close to the Scheme. For noise and vibration-sensitive receptors more remote from the Scheme alignment, traffic noise from other main roads predominates, with contributions from the local minor road network and trains

using the Chester to Holyhead railway line. Significant roads within the study area include the, B5441 Welsh Road and B5129 Chester Road East.

12.4.2 Noise and vibration-sensitive receptors close to the alignment of the Scheme, and to affected routes, are generally residential dwellings including a traveller site, although there is a school, Sealand Primary School, and the Queensferry Campus in relative proximity.

Noise Priority Areas

12.4.3 A noise priority area in Wales is defined in the Noise and Soundscape Action Plan 2018-2023 as an area "where people's homes are exposed to a day-evening-night noise level exceeding 73 dB according to the 2017 noise maps, or where people live alongside concrete trunk roads".

12.4.4 Welsh Government published Round 4[18] strategic noise mapping in 2024, however at the time of writing, no update has been provided for noise priority areas. In the meantime, the Round 3[19] noise priority areas remain the most up to date indicators of populations exposed to the highest noise levels. There are a number of priority areas within or near to the Scheme extents; these are listed in Table 12-11. Volume 2 Figure 12.2 shows the location of the noise priority areas.

Table 12-11 Noise priority areas

Priority Area ID	Location	Receptor Class
404	A494(T) Garden City	Welsh Government
402	A494(T) adjacent Dundas Street, Queensferry	Welsh Government

[18] Welsh Government (2022) Environmental Noise Mapping 2022. DataMapWales. Available at: https://datamap.gov.wales/layergroups/geonode:Environmental_Noise_Mapping_2022 (Accessed: 20 May 2025).
[19] Welsh Government (2017) Environmental Noise Mapping 2017. Available at: https://gov.wales (Accessed: 20 May 2025).

Source: A noise action plan for Wales 2013 – 2018

Baseline Noise Measurement Survey

12.4.5 A noise survey was undertaken between 13th November 2024 and 23rd December 2024. Unattended measurements for a period of a week or more were undertaken in the rear gardens of two properties close to the A494 and short term (15 minute) measurements were undertaken on a number of occasions at a further four locations. Full details of the measurement locations are provided in Volume 3 Appendix 12-A. The measurement locations are shown in Volume 2 Figure 12.3. These measurement locations are considered representative of the noise sensitive receptors listed in the second column of Table 12-12 for the construction noise assessment.

12.4.6 Noise levels for noise sensitive receptors close to the A494 were dominated by traffic noise and were very consistent day-to-day. For the most exposed measurement locations, ambient noise levels were generally in the range of $L_{Aeq,16hour}$ 66 to 68 dB at the façade during the day-time and $L_{Aeq,8hour}$ 59 – 63 dB at night.

12.4.7 As traffic noise was the dominant source, noise levels expressed in terms of $L_{A10,18hour}$ at the façade were consistent with the $L_{Aeq,16hour}$ values with a range of 70 – 72 dB.

12.4.8 Short term measurements ranged between $L_{A10,15min}$ 59 – 68 and $L_{Aeq,15min}$ 58 – 67 dB during the daytime depending upon location. No short-term measurements were undertaken during the night-time.

12.4.9 The results of the survey are consistent with road traffic noise modelling with an allowance for uncertainty and provide an appropriate baseline for the construction noise assessment.

12.5 Mitigation Measures Forming Part of the Scheme Design

12.5.1 The assessment of effects assumes appropriate implementation of the identified mitigation measures which are based upon the principle of Best Practicable Means. The assessment does not assume that all possible mitigation measures

have been implemented; for example, while it might be possible to implement a temporary noise barrier at a given location, the efficacy of such a barrier would depend upon whether it can be practically installed to break line of sight of works to all affected windows on an overlooking receptor. This is not known at this stage in the Scheme so temporary barriers have not been included in the calculation of construction noise.

12.5.2 Similarly, plant noise levels are assigned based upon plant data published in the annexes of BS 5228-1. Quieter plant selections may be available to the Contractor depending upon site and construction constraints. Where sheet piling activities are predicted to present the potential for significant adverse effect, there is the potential for relatively low noise hydraulic pressed piling to be used. The construction noise assessment may therefore be considered conservative.

Construction

12.5.3 The impact of noise and vibration on nearby sensitive receptors within the vicinity of the Scheme will be controlled by implementation of the principle of Best Practicable Means (BPM). This will be achieved by undertaking construction activities in accordance with good practice set out in BS 5228 Parts 1 and 2.

12.5.4 The approach for controlling construction noise will be to reduce source levels where possible but with due regard to practicality. However, in some circumstances it may be preferable to use plant which generates a relatively high noise level if the overall construction time (and therefore length of disruption) is reduced.

12.5.5 Construction may take place throughout the week and weekend during both the day-time and night-time periods. Night-time works which occur in close proximity to residential receptors will be minimised as far as practicable. Limited works associated with the tie-in of the new carriageway to the existing road and the demolition of the existing gantry will be undertaken at night.

12.5.6 Piling works are one of the noisier aspects of construction and piling is an element of some of the proposed interventions, notably construction of retaining walls and foundations for gantries. According to BS 5228-1 (Noise) “[those undertaking piling

works] should take appropriate steps to reduce either the level or the annoying characteristics, or both, of the noise…". Quieter piling techniques e.g. rotary bored piles and pressed-in "silent" piling will be considered where there is close approach of works to noise sensitive receptors.

12.5.7 Temporary barriers that remove line of sight (from the receptor to the construction works) would be likely to reduce the resultant noise levels from construction works by 10 dB. Barriers will be installed if practical for works of protracted duration where significant adverse effects are considered likely. The noise estimates set out below assume that these have not been installed, however, where there are existing noise barriers which will be retained during construction, or there is shielding afforded to receptors by existing embankments (for example residents in Garden City will be shielded by the existing noise barrier and by the massing of the existing eastbound carriageway during works to construct the eastbound carriageway), this shielding has been taken into account in construction noise calculations.

12.5.8 Whilst construction noise is likely to be disruptive at nearby residences at times, it will be controlled by the implementation of a Construction Noise and Vibration Management Plan (CNVMP), or as part of a Construction Environment Management Plan (CEMP).

12.5.9 Incorporated mitigation related to construction noise will be set out within the CEMP. This will identify the series of measures to reduce the environmental effects during the construction period and cover environmental and safety aspects affecting the interests of residents and the general public.

12.5.10 Where significant adverse effects are predicted, specific measures for mitigation will be discussed with FCC and described within the contractor method statements. Where noise limits have the potential to be exceeded, alternative methods will be considered in conjunction with the local authority. This will include application by the Main Contractor under Section 61 of the Control of Pollution Act 1974, the provision of noise insulation measures or temporary barriers.

12.5.11 Typical means by which noise and vibration will be minimised include the following:

- Selecting quiet equipment;
- Ensuring equipment is maintained in good working order and is used in accordance with the manufacturer's instructions;
- Members of the construction team trained and advised during tool box briefings on quiet working methods;
- Equipment not to be left running unnecessarily;
- Equipment fitted with silencers or mufflers;
- Plant enclosures used whenever feasible;
- Careful orientation of plant with directional features;
- Materials lowered instead of dropped from height;
- Informing nearby sensitive receptors in advance of construction activities and keeping them up to date with progress and changes;
- Giving nearby sensitive receptors access to a Public Liaison Officer, responsible for liaising with residents and maintaining good communications;
- Managing deliveries to prevent queuing of site traffic at access points; and
- Using adjustable, directional audible vehicle-reversing alarms or alternative warning systems (for example white noise alarms).

12.5.12 Good public relations are invaluable in securing public acceptance of construction noise. People are more tolerant of noise if they understand the reason for it, the likely duration, start and stop dates, and that everything is being done to minimise noise levels. Letter box drops explaining these shall be considered. A dedicated Public Liaison Officer will be nominated to liaise with residents and a complaint handling procedure will be set up.

12.5.13 Construction vibration is not anticipated to exceed PPV levels of 1.0mm/s at sensitive receptors, however vibration mitigation will also be set out within the CEMP.

12.5.14 Additional vibration mitigation measures include the following:

- Utilising low vibration working methods;
- Replacement of plant that is causing significant levels of vibration with other plant;
- Consideration of alternative methods; and

- Providing residents with advance notice of vibration inducing activities with a complaint process similar to the noise procedure set out above.
- Mitigation specific to site compounds is considered in Section 12.6.

Operation

12.5.15 The existing section of the A494 incorporates a number of road-side noise barriers which will be retained upon implementation of the Scheme. The existing barrier adjacent to the eastbound carriageway beginning immediately to the east of the Dee Bridge will remain in its current alignment.

12.5.16 Preliminary modelling of operational noise due to implementation of the Scheme determined that an additional noise barriers would be required adjacent to the westbound carriageway. This was due to three factors:

- the reduction in separation between receptors and the westbound carriageway following implementation of the Scheme;
- the demolition of intervening buildings and structures which currently provide acoustic shielding to some receptors.

12.5.17 A new 2m high reflective noise barrier will be incorporated adjacent to the westbound carriageway, immediately to the west of the Dee Bridge, to provide acoustic shielding for the existing gypsy traveller site.

12.5.18 In addition to the noise barrier, it was determined that the potential for significant adverse effects could be further mitigated by the implementation of a low noise surface to the carriageway. With the exception of the Dee Bridge deck, a low noise stone mastic asphalt (SMA) surface will be used for new surfaces within the Scheme extents. The extents of low noise surfacing of the project can be seen in the Pavement, Kerbings and Footways drawings (395318-MMD-00-XX-DR-C-0701 to 395318-MMD-00-XX-DR-C-0704). It is also understood that the road between the railway underbridge and the Queensferry interchange will be surfaced with SMA due to maintenance. However, as outlined in the Section 12.3.24, this associated noise reduction has not been quantified in the noise model.

12.6 Assessment of Potential Construction Effects

Construction Plant Inventory

12.6.1 An inventory of construction plant which is likely to be used for each of the main construction activities which will be required for construction of the Scheme is provided in Volume 3 Appendix 12-B Construction Noise Assessment. The inventory is based upon that provided in the Construction, Buildability and Phasing Report. This inventory, along with the current draft construction programme, forms the basis of the construction noise and vibration assessment reported below.

12.6.2 Note that, at this stage in the development of the Scheme, the construction methodology is under development. The information upon which this assessment is based is therefore provisional and may change as the Scheme is developed. The construction noise and vibration assessment, while based upon the best state of knowledge at the time of writing, should be regarded as provisional and will need to be revisited as the construction period approaches and methodologies become clear.

Airborne Construction Noise

Construction Noise Receptors

12.6.3 The noise sensitive receptors which may experience adverse effects from airborne construction noise are grouped within a number of locations close to the Scheme at which baseline noise levels have been determined from the survey reported in Volume 3 Appendix 12-A. A summary of the receptor locations and assigned exposure class from BS 5228-1 ABC method is shown in Table 12-12. A reference consistent with that for the representative baseline measurement locations has been assigned to the receptor locations.

12.6.4 It is assumed, for the purposes of the assessment, that any works undertaken in the evening period (19:00 – 23:00) will also occur within the more sensitive night-time period. A separate analysis has not therefore been undertaken for the evening period which is taken to include Saturdays (13:00 – 23:00) and Sundays (07:00 – 23:00). Moreover, the threshold for potential significance for night-time

category C is $L_{Aeq,T}$ 55 dB, equivalent to the evening threshold for the most sensitive category A locations. This assessment can therefore be considered conservative in that regard.

Table 12-12 Main noise sensitive receptor locations and associated ABC category

Ref.	Location	Baseline noise level $L_{Aeq,T}$ (dB) and Category ABC			
		Day		Night	
LT1	Riverside properties, Claremont Avenue, Garden City	56 – 60	A	49 – 56	C
LT2	Dundas Street and Queen Street, Queensferry	63 – 65	B	56 – 60	C
ST1	Western extent of Queen Street, Queensferry	58 – 60	A	-	C*
ST2	Gypsy traveller site, Queensferry	66 – 67	B	-	C*
ST3	Claremont Avenue, Garden City	60 – 64	A	-	C*
ST4	Adjacent to Drybridge Farm, Chester Road East, Deeside	61 – 64	A	-	C*

**Predicted based upon Welsh Noise Mapping*

12.6.5 Using methodology set out in BS 5228-1 the distance at which the noise level associated with each construction activity will fall below the thresholds for SOAEL has been predicted, without screening from barriers or other features such as the massing of intervening buildings. This information is tabulated in Volume 3 Appendix 12-B.

12.6.6 Further specific calculations have been undertaken at the sensitive receptor locations represented by the baseline noise measurement locations set out in Table 12-12. For these locations the influence of screening from intervening features, such as retained noise barriers or the massing of existing road embankments and buildings, has been taken into account.

12.6.7 The predicted construction noise level has been assessed in accordance with the approach set out in Section 12.3 to determine whether there is the potential for a significant adverse effect from construction activities.

12.6.8 The results of the assessment of construction noise for all construction activities and representative receptors are presented in Volume 3 Appendix 12-B.

12.6.9 A summary of the results for those receptors where the assessment predicts a significant adverse effect during day-time and night-time works is presented in Table 12-13.

Table 12-13 Representative receptors where there is a significant adverse effect from works

Construction Activities	**Receptor Locations with Potential for Significant Adverse Effects**	
	Daytime	**Night-time**
Far-east compound establishment		
Site clearance	none	n/a
Fencing	none	n/a
Main compound establishment		
Site clearance	none	n/a
Fencing	none	n/a
Site laydown compound establishment		
Site clearance	none	n/a
Fencing	none	n/a
Demolition works		
Demolition of buildings	ST2	n/a
Demolition of houses	ST1, ST4	n/a

Construction Activities	Receptor Locations with Potential for Significant Adverse Effects	
	Daytime	**Night-time**
Demolition of old pumping station	ST2	n/a
Demolition of concrete plinth	none	n/a
Demolition of River Dee Bridge	LT1	n/a
Demolition of gantry	none	none
Construction of carriageways (including tie-in)		
Site clearance	LT1, ST2, ST3	n/a
Drainage	ST2	n/a
Earthworks	ST2, ST3	n/a
River Dee Bridge in river works & abutments	ST2	n/a
River Dee Bridge	ST2	n/a
Pavement foundation construction	ST2	none
Pavement	ST2, ST3	none
Signs and lines	ST2	none
VRS and lighting	ST2	none
Installation of new River Dee Bridge		
Install new River Dee Bridge & Abutments	LT1	n/a
Accommodation works to Riverside Way		
Earthworks	ST2	n/a
Pavement foundation construction	ST2	n/a
Pavement	ST2	n/a
Construction of cycleways		
Site clearance	LT1, LT2, ST1, ST2, ST3, ST4	n/a

Construction Activities	Receptor Locations with Potential for Significant Adverse Effects	
	Daytime	**Night-time**
Earthworks	LT1, ST2, ST4	n/a
Cycleway foundation construction	LT1, ST2, ST4	n/a
Cycleway construction	LT1, LT2, ST1, ST2, ST3, ST4	n/a
Signs and lines	LT1, ST2, ST4	n/a
Miscellaneous directional drilling activities		
Utilities installation	LT1, LT2, ST1, ST2, ST3, ST4	none
Construction of temporary jetty's		
Installation and removal of temporary jetty's	LT1	n/a
Construction of pumping station		
Temporary works	ST2	none
Reinforced concrete boxes	ST2	none
Backfill	ST2	none

12.6.10 Night-time works will be minimised as much as practicable, although constraints on construction will necessitate night-time works when completing the tie-in of the eastbound and westbound carriageway, and the dismantling of the gantry north of the existing eastern abutment. Due to night-time works being limited in extent and for a duration not exceeding the 10 days in 15 consecutive days threshold, they are not anticipated to result in a significant adverse effect.

12.6.11 Any works outside normal working hours, which would be considered to be a Monday to Friday 07:30 – 17:30, would be subject to an agreement with the Welsh Government and the FCC Environmental Protection team.

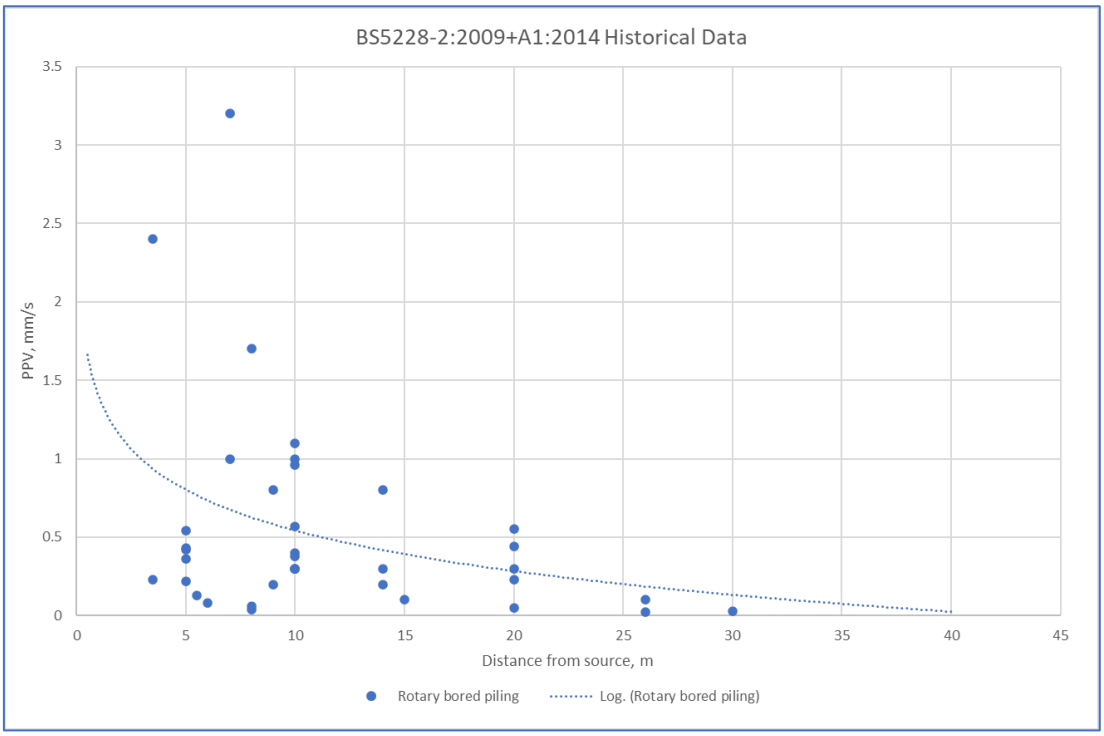
Assessment of Construction Vibration from Piling Operations

Rotary bored piling

12.6.12 This section presents the assessment of the significance of vibration arising from rotary bored piling operations, associated with the installation of the new River Dee Bridge.

12.6.13 BS5228-2:2009+A1:2014 provides historical vibration levels for rotary bored piling. The vibration data covers a range of variables which include, soil conditions, pile dimensions and theoretical energy per blow. The data from the BS5228-2:2009+A1:2014 is presented graphically in Figure 12-1 below with a trend for reduction of vibration level with distance from construction plotted. At this stage of the Scheme development, it is not possible to determine these variables for the piling works and therefore, the trend line from Figure 12-1 has been used to determine the distances from piling works where an exceedance above SOAEL (1.0 mm/s) is likely.

Figure 12-1 Historical measured vibration levels from the BS5228-2:2009+A1:2014 for rotary bored piling



Source: Mott MacDonald, 2025 and BS 5228-2:2009+A1:2014

Human receptors (residential and non-residential)

12.6.14 Reference to the trend line through historic data presented in Figure 12-1 indicates that receptors located approximately 3m or less from the rotary bored piling works are predicted to experience a PPV of above 1.0 mm/s. As the spread of data indicates, there is a degree of uncertainty in this prediction. As the nearest receptor is over 70m from the piling works, no receptors are likely to experience vibration levels above the SOAEL and therefore, rotary bored piling operations are not anticipated to result in a significant adverse effect.

Heritage assets

12.6.15 Reference to Figure 12-1 indicates that rotary bored piling would not generate vibration levels close to heritage assets damage PPV criteria of 2 mm/s referenced in Table 12-8 and therefore, no additional consideration is required.

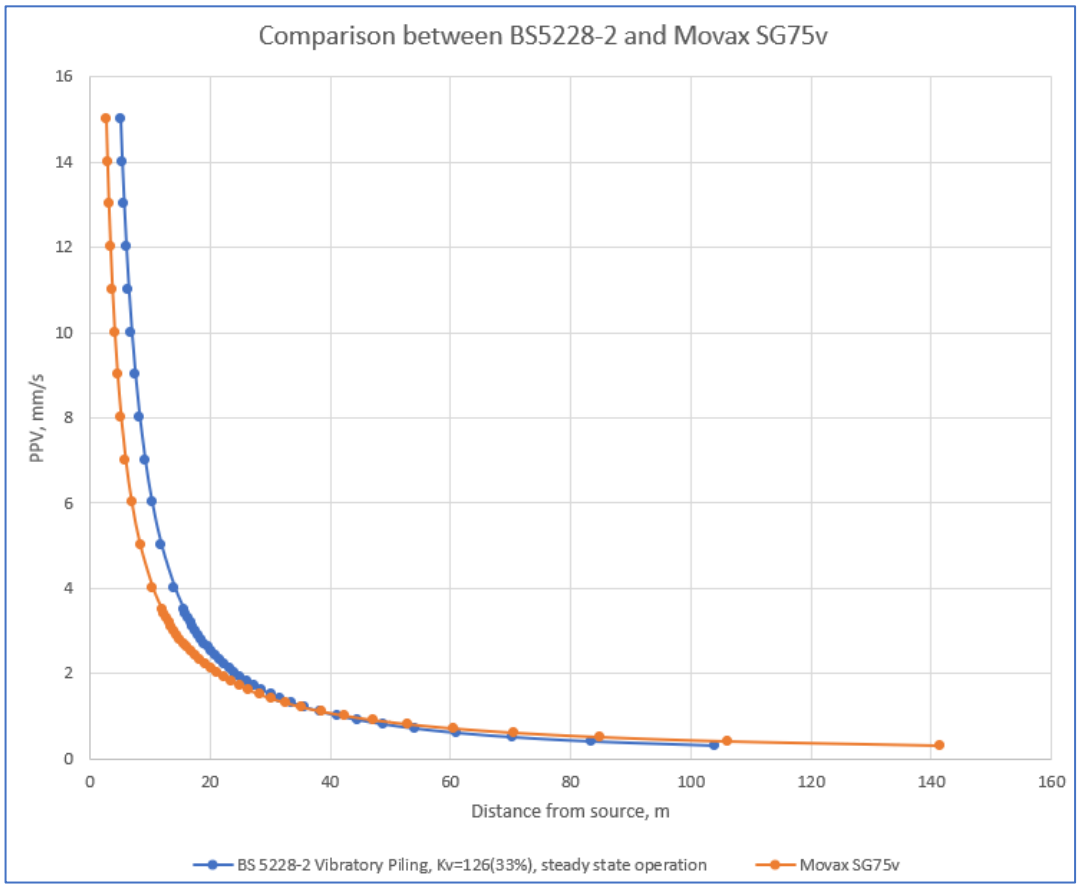
Sheet piling

12.6.16 This section presents the assessment of the significance of vibration arising from temporary vibratory sheet piling operations. Temporary sheet piling will be required for the following construction activities:

- Construction and removal of a temporary jetty on the right bank of the River Dee immediately to the south east of the bridge alignment.

12.6.17 Table E.1 of the BS5228-2:2009+A1:2014 provides a relation for the prediction of ground borne vibration arising from vibratory piling with distance. This relation was used to plot the predicted PPV against distance from vibration source. Ground vibration estimation information with distance for a Movax SG75v vibratory pile driver is also available in literature produced by Volker Ground Engineering. Predicted curves of PPV with distance from both these sources are presented in Figure 12-2.

Figure 12-2 Empirical predictor vibration levels from the BS5228-2:2009+A1:2014 for vibratory piling and Movax SG75v ground vibration estimation information



Source: BS 5228-2:2009+A1:2014 and Volkner Ground Engineering

Human receptors (residential and non-residential)

12.6.18 Reference to Figure 12-2 indicates that receptors located approximately 42m or less from the vibratory sheet piling works may experience a PPV of above 1.0mm/s. There are, however, no vibration sensitive receptors that fall within 42m from these piling works. Sheet piling operations are not therefore anticipated to result in significant adverse effects for human receptors.

Heritage assets

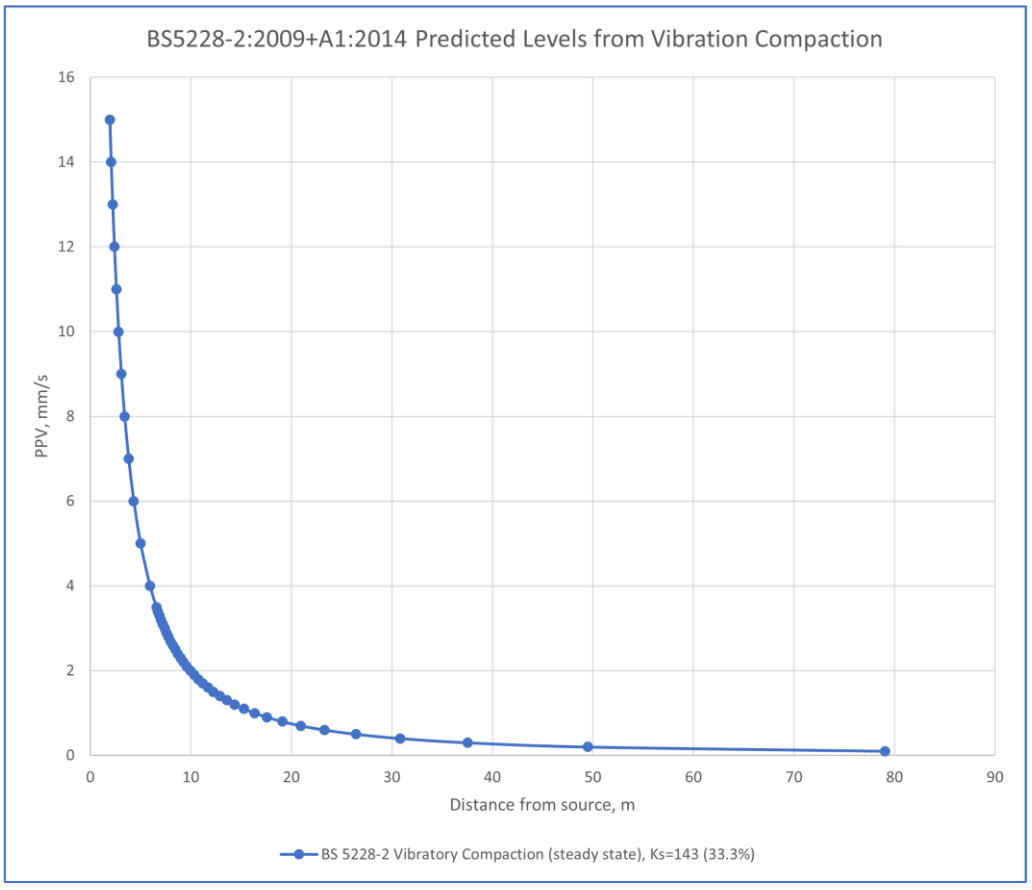
12.6.19 Reference to Figure 12-2 indicates that heritage structures located approximately 25m or less from the sheet piling works may experience a PPV of above 2.0 mm/s. There are, however, no heritage assets identified to fall within 25m of the sheet piling works; therefore no additional consideration is required.

Vibratory compaction

12.6.20 Vibratory compaction is anticipated to occur for a number of construction activities throughout the construction programme, activities including vibratory rollers for the construction of the pavements of the carriageways and cycleways.

12.6.21 The approach for predicting vibration from vibratory compaction is considered to be worst case based on the data in which the empirical equation from Table E.1 of BS5228-2:2009+A1:2014 “vibratory compaction (steady state)”. This relation was used to plot the predicted PPV against distance from vibration source. This has been presented in Figure 12-3.

Figure 12-3 Empirical predictor vibration levels from the BS5228-2:2009+A1:2014 for vibration compaction



Source: Mott MacDonald, 2025 and BS 5228-2:2009+A1:2014

Human receptors (residential and non-residential)

12.6.22 The predicted PPV due to the steady state operation of vibratory compaction is estimated to exceed the SOAEL PPV of 1.0 mm/s for vibration annoyance within approximately 16m of works, as indicated in Figure 12-3. The vibration receptors that fall within 16m of the abovementioned construction activities include those located at the gypsy travellers' site for pavement works on Riverside Way, and those on the western end of Claremont Avenue for pavement works associated with the cycleways.

12.6.23 Vibratory compaction associated with the cycleway pavement works is unlikely to exceed the threshold (10 consecutive days within any 15 or any 30 days within any 6-month period), the effect is considered to be not significant.

12.6.24 Vibratory compaction associated with pavement works on Riverside Way is likely to exceed the threshold (10 consecutive days within any 15 or any 30 days within any 6-month period), the effect is there considered to result significant adverse effect for receptors located on the north-western extent of the gypsy and traveller's site.

Heritage assets

12.6.25 Prediction of PPV with distance indicates that heritage buildings or structures located within approximately 10m from vibratory compaction may experience a PPV of 2.0 mm/s or more (as indicated in Figure 12-3). Heritage assets identified to fall within 10m of the vibratory compaction works are:

- Aston Quay Building
- Queensferry Shipyard II
- Aston Quay: port
- Aston Quay Landing Stage III
- Aston Quay Landing Stage IV

12.6.26 The value of these assets range from low to medium, as stated in the Archaeology and Cultural Heritage Chapter 10 of the ES.

12.6.27 Of the five asset locations anticipated to experience vibration levels exceeding a PPV of 2 mm/s, advice from the project heritage consultant indicates that assets 43 and 46 although shown on historic mapping, lie under the existing road infrastructure. Surviving elements of assets 48, 50 and 51 will be removed by earthworks associated with the new bridge construction. There is not therefore any likely impact on these structures associated with vibratory compaction works. As a result, no additional consideration associated with these assets are required.

12.6.28 Refer to Archaeology and Cultural Heritage Chapter 10 for further information on these assets.

Assessment of Construction Compounds

12.6.29 The extent of the Scheme comprises of three areas that will be needed for the construction phase of the project. The first area is brownfield land utilised for the main site compound south-west of the River Dee and Riverside gypsy traveller site. The main compound facilities including welfare cabins and materials storehouses will be located here. The second area is currently agricultural land on the eastern bank of the river and south of the existing bridge. Further welfare cabins will be located in the eastern bank compound. The third area will be situated between the B5129 Chester Road East and the Scheme alignment to the east of the Queensferry junction of the A494 and will operate as a site laydown. Minimal activity is anticipated at the site laydown compound. All three compounds will be accessed off the existing A494.

12.6.30 Further details of the site compounds, and estimated sizes and locations, can be found in the Construction, Buildability and Phasing Report.

12.6.31 A quantitative assessment of works to set up the compounds is included in the assessment of construction noise reported above. Detailed information on plant and usage of the compounds is not however available at this preliminary design stage although equipment such as heavy vehicles, cranes and forklift trucks will access the compounds which will generate noise on an intermittent basis. The compounds will include welfare facilities, temporary site offices and cabins which may require the use of a generator should mains power not be available. There is

also a requirement for parking for staff and visitors and the delivery and storage of materials.

12.6.32 Likely noise mitigation for construction compounds will be set out within the CEMP and will include:

- Setting out compounds to ensure noise generating activities are as remote from sensitive receptors as practical;
- Acoustic enclosure of external plant (such as generators);
- Temporary noise barriers where there are sensitive receptors close by;
- Restrictions on delivery times; and
- Appropriate location of ingress and egress point.

12.6.33 The site laydown at Chester Road East and main compound south-west of the River Dee are in proximity to a residence at Drybridge Farm (ST4) and the traveller's site, respectively. The compound on the eastern bank of the River Dee is also in proximity to a receptor on Foxes Lane, close to the A494. Due to the proximity of these sensitive receptors to the A494, prevailing noise levels are relatively high. Application of the mitigation measures described above and within the CEMP will ensure that noise emission from the compounds will be controlled as far as is practicable. No significant adverse noise and vibration effects are anticipated due to operation of the compounds.

Assessment of Construction Traffic

12.6.34 Construction traffic includes deliveries to site, transportation of cut and fill materials and attendance at site by construction personnel. To increase noise levels for roadside noise sensitive receptors, construction traffic would need to increase traffic flow on a given road by 25% or more. It is anticipated that the majority of construction traffic will use the A494 to access the construction compounds, therefore it is considered unlikely to utilise access roads remote from main routes. Where construction traffic will need to traverse such locations, construction traffic routing will be considered in the CEMP and a strategy for managing construction traffic will be agreed in advance of works with FCC. No

significant adverse noise and vibration effects are anticipated due to construction traffic associated with the Scheme.

12.7 Assessment of Potential Operational Effects

12.7.1 The short-term and long-term noise levels without the proposed scheme, resulting from traffic growth on the existing infrastructure, as well as the short-term and long-term noise impacts resulting from implementation of the Scheme have been assessed. This assessment is presented below.

Assessment of Impact for DMRB Scenarios

12.7.2 The DMRB LA 111 assessment summary tables are presented in 12-14, 12-15 and 12-6. Contour maps of the $L_{A10,18hour}$ index, illustrating predicted noise levels, and noise difference contours illustrating predicted noise changes for the DMRB assessment scenarios, are shown in Volume 2 Figures 12.4 to 12.11.

12.7.3 All of these comparisons have been made for the daytime and night-time (comparing the $L_{A10,18hour}$ index in the two scenarios) and are reported for the number of receptors within the study area that are subject to no change or negligible, minor, moderate or major changes that may be either increases or decreases. The receptors include both residential receptors (dwellings) and non-residential receptors (such as medical facilities, schools and places of worship). For the calculation area in this assessment there are 1344 residential receptors and 223 non-residential receptors.

Long Term Impacts Do minimum 2026 and Do minimum 2041

12.7.4 Long term impacts without the proposed scheme are assessed by comparing the Do minimum scenario in the opening year (2026) with the Do minimum scenario in the future assessment year (2041). These impacts are presented in Table 12-14.

Table 12-14 Long term change in noise levels (Do minimum 2026 and Do minimum 2041)

Change in noise level		Daytime		Night-time	
		Number of dwellings	Number of other sensitive receptors	Number of dwellings	Number of other sensitive receptors
Increase in noise level, $L_{A10,18hour}$ High Medium Low	0.1 – 2.9	1299	198	1288	197
	3.0 – 4.9	0	0	0	0
	5.0 – 9.9	0	0	0	0
	10.0 +	0	0	0	0
No change	0	43	17	54	18
Decrease in noise level, $L_{A10,18hour}$	0.1 – 2.9	2	8	2	8
	3.0 – 4.9	0	0	0	0
	5.0 – 9.9	0	0	0	0
	10.0 +	0	0	0	0

12.7.5 All noise sensitive receptors (NSRs) are predicted to be subject to no change, or negligible noise impacts without the implementation of the proposed scheme in

the long-term. Traffic will generally increase, and this yields negligibly small increases in noise for most NSRs.

Short Term Impacts Do minimum 2026 and Do something 2026

12.7.6 Table 12-15 compares the noise levels in the short term for the Do minimum scenario in the opening year against Do something in the opening year.

Table 12-15 Short term change in noise levels (Do minimum 2026 and Do something 2026)

Change in noise level		Daytime		Night-time	
		Number of dwellings	Number of other sensitive receptors	Number of dwellings	Number of other sensitive receptors
Increase in noise level, $L_{A10,18hour}$ High Medium Low	0.1 – 0.9	288	64	272	62
	1.0 – 2.9	9	1	8	1
	3.0 – 4.9	0	1	0	1
	5.0 +	0	0	0	0
No change	0	811	139	838	142
Decrease in noise level, $L_{A10,18hour}$	0.1 – 0.9	196	12	191	11
	1.0 – 2.9	32	4	28	4

Change in noise level		Daytime		Night-time	
		Number of dwellings	Number of other sensitive receptors	Number of dwellings	Number of other sensitive receptors
	3.0 – 4.9	6	2	7	2
	5.0 +	2	0	0	0

12.7.7 In the short term no residential receptors are predicted to experience a noise increase of +3.0 dB or more which would be considered to represent an impact greater than minor.

12.7.8 In the short-term, one non-residential receptor is anticipated to experience a noise increase in the short term of more than 3.0 dB. This is the north-west facing façade of the Makro wholesale store located at Ffordd Pentre, Chester Road East, Queensferry. The noise increase is due to the closer proximity of the westbound carriageway and the demolition of buildings which currently are situated between Makro and the alignment of the A494 for the implementation of the Scheme. The use of this site as a wholesale store is not regarded as having high sensitivity to change in noise. The building envelope appears to contain little glazing, and the north-western façade does not form access for customers using the store. It is considered unlikely that the behaviour of building users will change due to the increased noise level at this façade. This noise increase is not therefore considered to result in a significant adverse effect. Therefore, in the short term, no noise sensitive receptors are predicted to experience a moderate or major adverse impact with a noise change of +3.0 dB or greater.

12.7.9 In the short term, one non-residential receptor where the do something noise level is above SOAEL is predicted to experience a noise change greater than 1 dB. This

receptor is Bromborough Plastics, and is not considered to have a high sensitivity to noise. It is considered unlikely that the behaviour of the building users will change due to the increased noise level in the short-term. This noise increase is not therefore considered to result in a significant adverse effect.

12.7.10 Several residential and non-residential receptors are predicted to experience a noise reduction of $L_{A10,18hour}$ between 3.0 and 4.9 dB or over 5 dB in the short term.

Long term impacts: Do minimum 2026 and Do something 2041

12.7.11 Table 12-16 compares the noise levels in the long term for the Do minimum scenario in the opening year against Do something in the future assessment year.

Table 12-16 Long term change in noise levels (Do minimum 2026 and Do something 2041)

Change in noise level		Daytime		Night-time	
		Number of dwellings	Number of other sensitive receptors	Number of dwellings	Number of other sensitive receptors
Increase in noise level, $L_{A10,18hour}$ High Medium Low	0.1 – 2.9	1234	196	1227	195
	3.0 – 4.9	0	1	0	1
	5.0 – 9.9	0	0	0	0
	10.0 +	0	0	0	0
No change	0	38	14	46	15

Change in noise level		Daytime		Night-time	
		Number of dwellings	Number of other sensitive receptors	Number of dwellings	Number of other sensitive receptors
Decrease in noise level, $L_{A10,18hour}$	0.1 – 2.9	65	10	66	10
	3.0 – 4.9	6	2	5	2
	5.0 – 9.9	1	0	0	0
	10.0 +	0	0	0	0

12.7.12 In the long term, no residential NSRs are predicted to experience an adverse impact greater than a negligible impact. One non-residential NSR at the north-west facing façade of the Makro wholesale store is predicted to experience a minor adverse impact in the long term.

12.7.13 One residential receptor at Claremont Avenue is predicted to experience a noise reduction of $L_{A10,18hour}$ between 5.0 and 9.9 dB in the long term.

Significance of effect

12.7.14 Using the methodology for determining significance from DMRB LA111, no significant adverse effects due to operational traffic noise resulting in moderate or major noise increases are predicted in the short term or long term.

12.7.15 One residential receptor, Drybridge Farm, is predicted to experience noise levels of both day and night-time below SOAEL with a minor noise change in short term

that is not considered a significant adverse effect in the initial assessment. Although night-time absolute noise levels are predicted above the SOAEL in do-something future year scenario, the long term change in noise assessed is negligible. The increase in absolute noise level is primarily attributed to the long term traffic growth. Therefore, the impact of this receptor does not result in significant adverse effects.

12.7.16 Furthermore, it is understood that a SMA road surface will be implemented between the railway underbridge and Queensferry interchange which is expected to provide noise benefit, however, the potential noise reduction associated with this surfacing has not been quantified within the noise model.

12.7.17 In the short term some 8 residential receptors and 2 non-residential receptors are predicted to experience moderate or major beneficial impacts during the day-time. 7 residential receptors and two non-residential receptors are predicted to experience moderate or major beneficial impacts at night.

12.7.18 Of the receptors predicted to experience a moderate or major beneficial impact in the short term, one residential receptor is predicted to experience a moderate beneficial impact during the day in the long term. No receptors are predicted to experience a moderate beneficial impact at night during the long term.

12.7.19 All but one of the non-residential receptors have been identified as commercial premises which would not be considered to have a high sensitivity to noise. The exception to this is Harry Weale Hall, Station Road, Queensferry which houses an Army Reserve centre. This receptor has been considered a noise sensitive receptor during the day-time period. There is a residential caretaker flat within the premises at Harry Weale Hall. This has been considered a residential noise sensitive receptor during the daytime and night-time period in this assessment.

12.7.20 Using the approach to determine final operational significance set out in Table 3.60 of DMRB LA 111, only those NSRs where there is a moderate or major impact in the short term, and there remains a long term impact of at least moderate are considered as being subject to a significant effect.

12.7.21 On that basis number 3 Claremont Avenue has been identified as having a significant beneficial effect resulting from implementation of the Scheme during the day-time.

12.7.22 No receptors have been identified as having a significant beneficial effect resulting from implementation of the Scheme during the night-time.

12.8 Noise changes for routes more than 600m from the Scheme

12.8.1 DMRB LA111 recommends that calculated BNL should be reported for routes remote from the Scheme, where a short term BNL change of greater than 1.0 dB(A) occurs due to implementation of the Scheme. Analysis of forecast traffic data indicates that there are no routes outside of the operational noise study area that result in short term BNL changes of greater than 1.0 dB(A) due to implementation of the Scheme.

Changes in Noise Priority Areas

Review of the predicted noise changes which occur at the locations of the noise priority areas, identified in 12-11, indicates the following:

- Receptors on Riverside Park, Garden City, that are within Priority Area 404, show a negligible change in both the short-term and the long term;
- Receptors on Dundas Street, that are within Priority Area 402, show a negligible change in both the short-term and the long term;

12.9 Additional Mitigation and Monitoring

Construction Noise and Vibration

12.9.1 Where a significant adverse effects has been predicted by the construction noise assessment during the daytime, it will be necessary to control noise through scheduling of the works or the provision of noise barrier mitigation to ensure that where reasonably practicable the SOAEL level is not exceeded for 10 or more days or nights in 15 consecutive days or nights, or more than 40 days in any six consecutive months. In addition, the Contractor will seek to obtain consent for

works from FCC under Section 61 of the Control of Pollution Act 1974. Provided appropriate and specific controls are in place to mitigate effects by the Contractor, the potential for significant residual effects during construction is unlikely.

Operational Noise

12.9.2 The assessment of operational noise impacts and associated effects did not identify any significant adverse effects from operational traffic noise due to implementation of the Scheme. No additional mitigation or monitoring is therefore proposed for operational noise.

12.10 Assessment of Cumulative Effects

12.10.1 Several nearby projects have been assessed for cumulative construction and operational noise impacts within a 1km radius of the Dee Bridge Scheme:

- Anaerobic Digester Waste Facility (Sandycroft): Although within 350m of shared noise-sensitive receptors (ST4), cumulative effects are not anticipated due to limited overlapping works and shielding from buildings.
- HyNet Carbon Dioxide Pipeline: Expected to begin in 2026 and run concurrently with Dee Bridge construction. At a 800m distance, cumulative noise effects are predicted to be negligible.
- Sealand Manor Solar Farm: Located near eastern carriageway works but in early planning stages. Concurrent construction is unlikely, so cumulative effects are not expected.
- A55/A494/A548 Flintshire Corridor Infrastructure Project: If construction overlaps, cumulative effects from traffic and diversions could occur, especially with potential A548 closures. However, construction is likely to begin after the Dee Bridge Scheme, making construction cumulative effects unlikely.

12.10.2 Further information on the cumulative effects of the Scheme with other projects in are addressed in Chapter 17 Cumulative Effects and Inter-relationships.

12.11 Inter-relationships

Chapter 08: Terrestrial Biodiversity and Chapter 16 Marine Ecology

12.11.1 There is an inter-relationship between the assessment of noise and vibration and nature conservation assessment, in that noise and vibration emissions from construction of the Scheme have the potential to impact upon natural receptors such as birds and riverine species such as migrating fish. The effects upon birds have been assessed in Chapter 8 Terrestrial Biodiversity. The effects upon migrating fish from noise and vibration associated with construction works in the River Dee has been assessed in Chapter 16 Marine Ecology.

Chapter 9: Landscape and Visual

12.11.2 There is an inter-relationship between the noise assessment and the landscape and visual assessment in so far as the visual impacts of incorporated noise mitigation in the form of noise barriers is considered within that assessment. A new barrier will be incorporated immediately to the west of the Dee Bridge adjacent to the westbound carriageway to provide acoustic shielding to the Riverside gypsy traveller site. This barrier is required due to the A494 road alignment sitting in closer proximity to the receptors. The existing barrier adjacent to Garden City will remain unchanged.

12.11.3 Chapter 9 of the ES considers the impacts of construction and operational noise changes upon tranquillity in the rural spaces close to the Scheme.

Chapter 11: Air Quality

12.11.4 There is an inter-relationship between the noise and air quality assessments in that there is the potential that, during the construction phase, receptors close to the works may be exposed to adverse air quality impacts from dust in conjunction with noise emissions from construction activities.

Chapter 15: Climate Change and Greenhouse Gas Emission

12.11.5 Climate change may have direct and indirect influences on noise within the study area. For example, increases in ambient temperature would influence sound propagation by reducing attenuation of sound due to air absorption, as well as other factors such as temperature inversions. Increased rainfall would increase the likelihood of moisture on the carriageway surface which would result in an

increase in noise from road traffic. A warmer climate may also increase the tendency of building occupiers to open windows for ventilation thereby increasing internal noise levels in spaces used for working and sleeping.

12.11.6 Notwithstanding the above, climate change is not expected to have any significant influence on the potential effects of the Scheme in terms of noise and vibration.

12.12 Summary of Effects

Construction

12.12.1 It is anticipated that there will be temporary significant adverse effects during the daytime due to the construction noise associated with works that have a duration greater than 10 or more days in any 15 consecutive days, or for a total of days exceeding 40 in any six-month period. Receptors anticipated to experience significant adverse effects are those residences situated on Claremont Avenue, the south-western end of Dundas Street, Queen Street, Drybridge Farm and the gypsy traveller's site.

12.12.2 Temporary significant adverse effects upon human receptors due to vibratory compaction associated with pavement works on Riverside Way are predicted for those receptors located on the north-western extent of the gypsy and traveller's site.

12.12.3 Temporary, significant adverse effects are identified on a precautionary basis due to construction vibration associated with vibratory compaction at undesignated heritage assets Aston Quay Building, Queensferry Shipyard II, Aston Quay; port, Aston Landing Stage III and Aston Quay Landing Stage IV.

12.12.4 Mitigation outlined in Section 12.5 has been considered, where applicable, in the assessment of construction noise impacts, although specific measures to further reduce noise levels have not been applied for the calculation of construction noise.

12.12.5 The principle of best practicable means for the control of construction noise will be implemented at all times throughout the construction period. Subject to practicality in a given location, mitigation measures will include the use of alternative

construction, programming of works to reduce the duration of activities outside of noise sensitive receptors to less than 10 days in 15 where practicable, and the provision of temporary barriers.

12.12.6 Where a significant adverse effects has been predicted by the construction noise assessment it will be necessary to control noise through scheduling of the works or the provision of noise barrier mitigation where practicable to minimise the disturbance to those receptors where works are anticipated for greater than 10 days in 15 consecutive days. In addition, the Contractor will seek to obtain consent for works from Flintshire Council under Section 61 of the Control of Pollution Act 1974.

12.12.7 No significant adverse effects on human receptors are anticipated due to construction vibration.

12.12.8 No significant adverse effects due to the operation of the main site compounds, satellite compounds or construction traffic are anticipated.

Operation

12.12.9 No significant adverse effects due to operation of the Scheme are predicted.

12.12.10 Numbers 3 Claremont Avenue has been identified as having a significant beneficial effect resulting from implementation of the Scheme during the day-time.

12.12.11 No receptors have been identified as having a significant beneficial effect resulting from implementation of the Scheme during the night-time.

12.12.12 No noise changes resulting in greater than a negligible impact in the Noise Priority Areas close to the Scheme are predicted (Noise Priority Areas are identified in Table 12-11).

Llywodraeth Cymru / Welsh Government

A494 RIVER DEE BRIDGE REPLACEMENT SCHEME

Environmental Statement

Volume 1: Technical Assessment Report

Chapter 13: Materials and Waste

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13. Materials and Waste

13.1 Introduction

13.1.1 This chapter addresses the likely significant effects of the proposed A494 River Dee Bridge Replacement works on material assets and waste management.

13.1.2 For the purposes of the assessment, waste and materials are defined as comprising:

a) The provision and use of material assets including primary, secondary, recycled and manufactured materials.

b) The generation and management of wastes.

13.1.3 Specifically, the UK has adopted the definition of waste as set out in the EU Waste Framework Directive 2008/98/EC as ‘any substance or object which the holder discards or intends or is required to discard’.

13.1.4 Impacts are likely to arise from the use and consumption of material assets required for the Scheme and the production and management of waste generated by the Scheme; these impacts would need to be managed and mitigated.

13.1.5 For the construction phase, the estimated key material assets proposed to be used include concrete, steel and aggregate. This has been assessed from the Preliminary Design and therefore subject to refinement as the design progresses.

13.1.6 The waste streams estimated to be generated as a result of this Scheme during construction are as follows:

a) Demolition waste

b) Inert construction waste

c) Non-hazardous construction waste

d) Non-hazardous excavated material (including invasive non-native species {INNS})

e) Inert excavated material

f) Potentially hazardous excavated soils – dependent on site condition but are anticipated to be low.

13.1.7 Assessment of impacts from INNS and management considerations are detailed in Chapter 8: Terrestrial Biodiversity.

13.1.8 The assessment in this chapter has considered the use of material assets relating to the construction of the Scheme. Use of material assets and generation and management of waste for the operational phase and sterilisation of Mineral Safeguarding Areas (MSA) and peat resources has been scoped out.

13.2 Legislation and Policy Framework

13.2.1 The relevant legislation, policies and guidance for the assessment of the environmental effects of the Scheme on material assets and waste are highlighted as follows

Legislation

a) Assimilated Law – Waste Framework Directive 2008/98/EC (WFD) [1];
b) Assimilated Law – Landfill Directive (1999/31/EC)[2]
c) The Environment Act, 2021[3]
d) Environment (Wales) Act 2016[4];
e) The Well-being of Future Generations (Wales) Act 2015[5]
f) Environmental Protection Act 1990[6];
g) Waste (England and Wales) Regulations 2011, as amended[7];
h) Waste (Wales) Measure 2010[8];

[1] European Union (2008). Directive (2008/98/EC) of the European Parliament and of the Council on Waste. Available online at http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32008L0098&from=EN. Accessed January 2025
[2] *European Union Council Directive* (1999). *Landfill Directive (1999/31/EC) [online]*. Available at: EUR-Lex - 31999L0031 - EN - EUR-Lex (europa.eu). Accessed January 2025
[3] His Majesty's Government (2021) The Environment Act 2021. Available online at: https://www.legislation.gov.uk/ukpga/2021/30/contents . Accessed January 2025.
[4] Environment (Wales) Act. Available online at http://www.legislation.gov.uk/anaw/2016/3/contents/enacted. Accessed January 2025
[5] Well-being of Future Generations (Wales) Act 2015. Available online at http://www.legislation.gov.uk/anaw/2015/2/contents/enacted Accessed January 2025
[6] Environmental Protection Act 1990 http://www.legislation.gov.uk/ukpga/1990/43/contents. Accessed 08/11/18
[7] Waste (England and Wales) Regulations 2011, as amended. Available online at http://www.legislation.gov.uk/ukdsi/2011/9780111506462/contents. Accessed January 2025
[8] Waste (Wales) Measure 2010. Available online at http://www.legislation.gov.uk/mwa/2010/8/contents. Accessed January 2025

i) Waste (Miscellaneous Provisions) (Wales) Regulations 2011[9];

j) Hazardous Waste (England and Wales) Regulations 2005, as amended[10];

k) Environmental Permitting (England and Wales) Regulations 2016[11];

l) Landfill (England and Wales) Regulations 2002, as amended[12];

m) Controlled Wastes (England and Wales) Regulations 2012[13]

n) The Waste (Circular Economy) Amendment Regulations 2020[14]

Policy

National

a) Planning Policy Wales[15];

b) National Natural Resources Policy[16]

c) Beyond Recycling 2021[17]

d) Waste Prevention Programme for Wales[18]

e) National Waste Strategy, Towards Zero Waste – One Wales: One Planet[19]

[9] Waste (Miscellaneous Provisions) (Wales) Regulations 2011. Available online at http://www.legislation.gov.uk/wsi/2011/971/made. Accessed 09/11/18
[10] Hazardous Waste (England and Wales) Regulations 2005. Available online at http://www.legislation.gov.uk/uksi/2005/894/contents/made. Accessed January 2025
[11] Environmental Permitting (England and Wales) Regulations 2016. Available at http://www.legislation.gov.uk/uksi/2016/1154/contents/made. Accessed January 2025
[12] The Landfill (England and Wales) Regulations 2002, as amended http://www.legislation.gov.uk/uksi/2002/1559/contents/made. Accessed January 2025
[13] His Majesty's Government (2012) Controlled Waste (England and Wales) Regulations 2012 [online]. Available at: www.legislation.gov.uk/uksi/2012/811/contents/made. Accessed January 2025.
[14] His Majesty's Government (2020) The Waste (Circular Economy) (Amendment) Regulations 2020 [online]. Available at: https://www.legislation.gov.uk/primary+secondary?title=%C2%B7%09Waste%20%28Circular%20Economy%29%20%28Amendment%29%20Regulation%202020. Accessed January 2025.
[15] Planning Policy Wales, Edition 10 (2018). Available online at https://beta.gov.wales/planning-policy-wales. Accessed January 2025
[16] National Natural Resources Policy (2017). Available online at https://gov.wales/topics/environmentcountryside/consmanagement/natural-resources-management/natural-resources-policy/?lang=en. Accessed January 2025
[17] Welsh Government (2021) Beyond Recycling. Available online at: https://www.gov.wales/beyond-recycling. Accessed February 2025.
[18] Waste Prevention Programme for Wales (2013). Available online at https://gov.wales/topics/environmentcountryside/epq/waste_recycling/prevention/waste-prevention-programme/?lang=en Accessed January 2025
[19] National Waste Strategy, Towards Zero Waste – One Wales: One Planet (2017). Available online at https://gov.wales/topics/environmentcountryside/epq/waste_recycling/zerowaste/?lang=en. Accessed January 2025

Regional

a) Net Zero Strategy: Build Back Greener 2021[20]

b) Construction and Demolition Sector Plan[21];

Local

13.2.2 Flintshire County Council Unitary Development Plan 2000-2015[28]

Guidance

a) Natural Resources Wales Guidance on Pollution Prevention 5 (GPP5) [22]

b) Natural Resources Wales Guidance on Pollution Prevention 6 (GPP6)[23]

c) Technical Advice Note 21: Waste[24];

d) Minerals Technical Advice Note (MTAN) Wales 1: Aggregates[25]

e) Separated Waste Collections for Workplace (Wales) [26]

f) Design Manual for Road and Bridges LA 110[27]

13.2.3 The following legislation and policies are explained further as they have been identified as particularly important for the proposed works.

13.2.4 The overarching European Directives that are applicable to the assessment of use of material and waste generation are set out below. Whilst it is acknowledged that the UK has left the European Union (EU) it should be noted that existing legislation which transpose these Directives remains in force as Assimilated law.

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[20] His Majesty's Government (2021) Net Zero Strategy: Build Back Greener. Available online at https://www.gov.uk/government/publications/net-zero-strategy. Accessed January 2025.
[21] Construction and Demolition Sector Plan (2013). Available online at https://gov.wales/topics/environmentcountryside/epq/waste_recycling/publication/canddsectorplan/?lang=en. Accessed January 2025
[22] Natural Resources Wales Guidance for Pollution Prevention (GPP) 5: Works and Maintenance in or near water (2018). Available at gpp-5-works-and-maintenance-in-or-near-water.pdf. Accessed February 2025
[23] Natural Resources Wales Guidance for Pollution Prevention (GPP) 5: Working at Construction and Demolition Sites (2023). Available at gpp-5-works-and-maintenance-in-or-near-water.pdf. Accessed February 2025
[24] Technical Advice Note 21: Waste (2014). Available online at https://gov.wales/topics/planning/policy/tans/tan21/?lang=en. Accessed January 2025
[25] Minerals Technical Advice Note (MTAN) Wales 1: Aggregates (2004). Available online at https://www.gov.wales/sites/default/files/publications/2018-09/mtan1-aggregates.pdf. Accessed February 2025
[26] Welsh Government (2024) Separated waste collections for workplaces [online] Available at https://www.gov.wales/separated-waste-collections-workplaces. Accessed January 2025.
[27] Highways England (2025). Design Manual for Road and Bridges LA 110 Materials assets and waste

EU Waste Framework Directive 2008/98/EC (WFD)

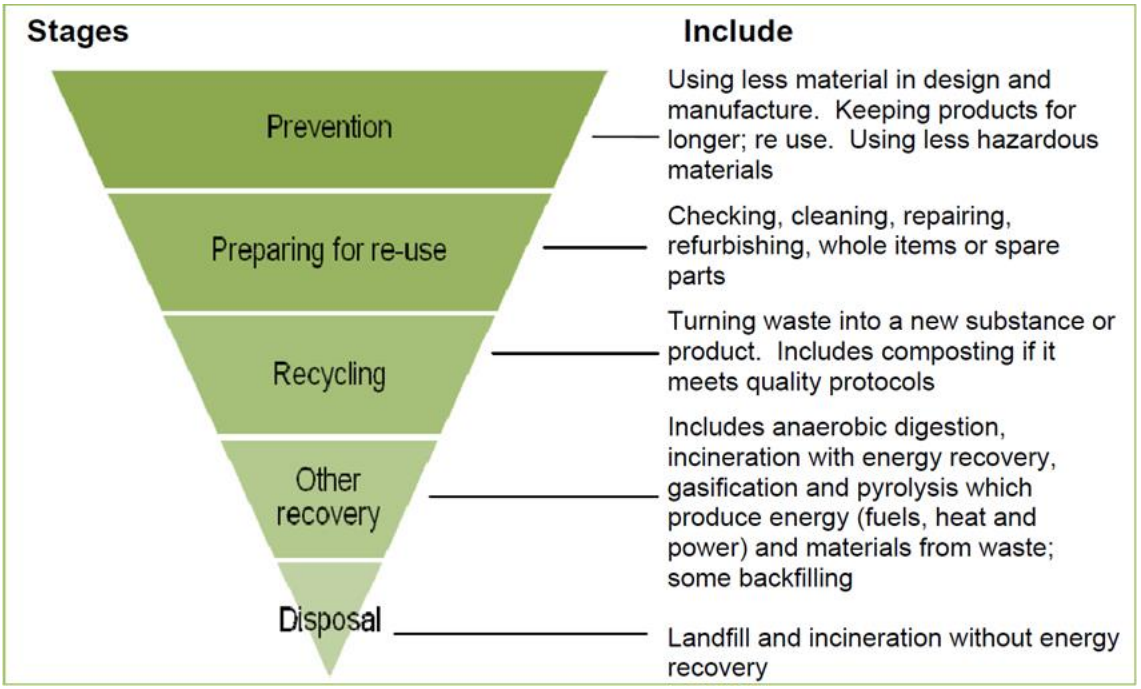
13.2.5 The WFD defines waste, recycling and recovery whilst also providing basic concepts and principles for waste management for Member States to adhere to. It clarifies how to determine when waste is no longer to be deemed as secondary raw material (the end-of-waste criteria) and provides an explanation of how to distinguish between waste and by-products.

13.2.6 The basic principles within the Directive are that waste must be managed without:

a) Endangering human health and without harming the environment.
b) Risk to water, air, soil, plants or animals.
c) Causing a nuisance through noise or odors; and,
d) Adversely affecting the countryside or places of special interest.

13.2.7 The Directive requires those who produce and manage waste to adopt the five-step waste hierarchy (Figure 13-1), which shows the order for priority for the management of waste: prevention; preparing for re-use; recycling; other recovery (for example, energy recovery); and disposal.

Figure 13-1 Waste Hierarchy



13.2.8 In addition, the following must be considered with regards to the management of waste: environmental protection principles, sustainability, technical feasibility,

economic viability, protecting resources, the overall environmental/human health/economic/social impacts.

Planning Policy

Flintshire County Council Unitary Development Plan 2000-2015[28]

13.2.9 The Flintshire Unitary Development Plan (UDP) currently guides Flintshire County Council's (FCC) approach to planning for sustainable development in the region. This is the adopted development plan alongside Future Wales: The National Plan. The UDP provides the framework for Authorities to make consistent planning decisions and details general policies on the control of new developments and changes in use of land or buildings. The Plan includes objectives, with corresponding policies, regarding minerals and waste to:

a) Encourage the reduction in the amount of waste produced

b) Encourage the use of waste disposal methods with minimal environmental impact (e.g. divert from landfill)

c) Enable the sustainable extraction of mineral resources

d) Protect sensitive areas from inappropriate minerals development

e) Mitigate the impact of minerals development on the environment;

f) Ensure the appropriate use of minerals; and

g) Ensure sites used for minerals purposes are restored to the highest possible standards.

13.2.10 FCC Topic Papers for waste and minerals explain potential policies to be implemented and the issues to be addressed in the LDP.

13.3 Assessment Methodology

13.3.1 The assessment has been undertaken in accordance with the Design Manual for Roads and Bridges (DMRB) LA110 Material Assets and Waste[29]. LA110 sets out the requirements for initial considerations when assessing the environmental impacts and

[28] Flintshire County Council Unitary Development Plan 2000-2015 (2011). Available online at http://www.cartogold.co.uk/flintshire/. Accessed January 2025

[29] National Highways (2019) Design Manual for Roads and Bridges LA110 – Material assets and waste [online]. Available at: https://www.standardsforhighways.co.uk/search/6a19a7d4-2596-490d-b17b-4c9e570339e9 Accessed January 2025.

effects of material assets and waste generation and its management for the construction and maintenance of motorways and roads. It promotes the reduction in overall impacts of material asset use and the efficient use of resources. It also promotes the prevention and/or reduction of impacts due to waste generation and management by adhering to the waste hierarchy principles.

13.3.2 The assessment for material assets and waste management has been carried out using estimated quantities where available, allowing for a more thorough review of impacts from the Scheme, but recognises the lack of information at this stage, particularly in relation to likely waste materials to be generated. The assessments consider the following elements:

a) The materials required for the Scheme and, where information is available, the quantities.

b) Details of the source / origin of materials, site-won materials to replace virgin materials, materials from secondary / recycled sources or virgin / non-renewable sources.

c) The cut and fill balance for any earthworks.

d) The types and quantities of waste arisings forecast from the Scheme, including the identification of any hazardous wastes expected.

e) Surplus materials and waste falling under regulatory controls.

f) Waste that requires storage on site before re-use, recycling or disposal.

g) Waste to be treated on site for re-use within the project.

h) Wastes requiring treatment and / or disposal off site.

i) The impacts that would arise from the use of materials and generation of waste.

j) A conclusion about the magnitude and nature of the impacts.

k) The identification of measures to mitigate the identified impacts.

Study area

13.3.3 The DMRB LA110 – Material assets and waste[29] provides definitions for two geographically different study areas to examine and assess the use of material assets and waste generation.

13.3.4 The first study area is the area within the construction footprint of the Scheme, or the Red Line Boundary, as this constitutes the area within which construction material

assets would be consumed (used, re-used and recycled) and waste would be generated. This first study area includes a 500m buffer around the Scheme extents and is used to identify potential sources of contaminated excavated waste within the first study area, based on a review of authorised and historic landfill sites which may impact on the Scheme.

13.3.5 For material assets, the second study area includes feasible sources and availability of construction material assets typically required for the works, the proximity principle and value for money. The study area for the sources and availability of construction material assets will focus primarily on Flintshire/North Wales for aggregates and nationally for concrete and steel.

13.3.6 For waste management, the second study area focuses on an area sufficient to identify the suitable waste infrastructure that could accept waste generated by the Scheme. It has been assessed based on an initial search area of 5km from the Scheme. Where sufficient capacity is not available, the search area has been extended accordingly, based on professional judgement, but kept within the boundaries of the Flintshire region.

Significance Criteria

13.3.7 DMRB LA110, Section 3, Part 13 has been used to identify significance criteria, to support professional judgement. This standard is primarily intended for motorway and all-purpose trunk road projects and provides more focused guidance for assessing the significance of potential effects resulting from material assets use and waste generation.

13.3.8 The effect/significance categories and typical descriptors for material assets and waste generation are provided in Table 13-1 and the level of significance are provided in Table 13-2. For both of these tables, “region” comprises the second study area, in this case Flintshire. “Primary material assets” describes material assets that are from a non-renewable source.

13.3.9 Professional judgement will be used to provide an assessment of effects based on several factors, including:

a) The availability of the material assets.

b) The type of material assets required, e.g., primary or virgin material assets, manufactured material assets, recycled material assets.

c) The type of waste generated, e.g., inert, non-hazardous or hazardous.

d) The availability of suitable facilities within close proximity to the Scheme to treat the waste generated.

e) Compatibility of the Best Practicable Environmental Option (BPEO) for the waste within the context of the waste hierarchy, i.e., whether generation of the waste can be minimised, the waste can be recycled, landfilled etc.

13.3.10 Significant environmental effects are more likely to arise from those material assets which:

a) Are associated with the largest quantities

b) Are primary or virgin material assets.

c) Have hazardous properties.

13.3.11 Significant environmental effects are more likely to arise from those wastes which:

a) Are associated with the largest quantities.

b) Have hazardous properties.

Table 13-1 Significance/effect categories and typical descriptors for material assets and waste generation

Effect	Description
Neutral	Material assets: Project achieves >99% overall material recovery or recycling (by weight) of non-hazardous Construction and Demolition (C&D) waste to substitute use of primary material assets. Aggregates required to be imported to site comprise >99% re-used or recycled content. Waste generation: No reduction or alteration in the capacity of waste infrastructure within the region.
Slight	Material assets:

Effect	Description
	Project achieves 70-99% overall material recovery or recycling (by weight) of non-hazardous C&D waste to substitute use of primary material assets. Aggregates required to be imported to site comprise re-used or recycled content in line with the relevant regional percentage target. Waste generation: ≤1% reduction or alteration in the regional capacity of landfill. Waste infrastructure has sufficient capacity to accommodate waste from a project, without compromising integrity of the receiving infrastructure (design life or capacity) within the region.
Moderate	Material assets: Project achieves <70% overall material recovery or recycling (by weight) of non-hazardous C&D waste to substitute use of primary material assets. Aggregates required to be imported to site comprise re-used or recycled content below the relevant regional percentage target. Waste generation: >1% reduction or alteration in the regional capacity of landfill as a result of accommodating waste from a project. 1-50% of project waste requires disposal outside of the region.
Large	Material assets: Project achieves <70% overall material recovery or recycling (by weight) of non-hazardous C&D waste to substitute use of primary material assets. Aggregates required to be imported to site comprise <1% re-used or recycled content. Project sterilises ≥1 mineral safeguarding site and/or peat resource. Waste generation: >1% reduction or alteration in the regional capacity of landfill as a result of accommodating waste from a project. >50% of project waste for disposal outside of the region.
Very Large	Material assets:

Effect	Description
	No criteria: use criteria for Large category above. Waste generation: >1% reduction or alteration in the national capacity of landfill as a result of accommodating waste from a project. Construction of new (permanent) waste infrastructure is required to accommodate waste from the project.

Source: National Highways (2019), DMRB LA110[29]

Table 13-2 Significance criteria for materials assets and waste generation

Significance	Description
Not Significant	**Material assets:** Category description met for Neutral or Slight effect. **Waste generation:** Category met for Neutral or Slight effect.
Significant (one or more criteria met)	**Material assets:** Category description met for Moderate or Large effect. **Waste generation:** Category met for Moderate, Large or Very large effect.

Source: National Highways (2019), DMRB LA110[29]

Assumptions and limitations

13.3.12 The materials assessment has been based on the description of the Scheme in Chapter 2 of this ES and the preliminary design. The assumptions made for the calculation of material quantities are outlined in Volume 3 Appendix 17.A Carbon Assessment Report. These figures are intended for the purpose of the current assessment only and have been based on a likely worst-case scenario. The sources of the materials required for the construction of the Scheme are not known at this stage. It has been assumed that bulk fill and most of the aggregates would be available regionally (within Flintshire), and that the balance would be obtained nationally (within the UK). This represents the (environmentally) worst-case scenario.

13.3.13 This assessment has not considered the environmental effects associated with the off-site extraction of raw materials used for the off-site manufacture of products (which

may occur outside of the UK). These stages of the products' or materials' life-cycles are outside of the scope of the assessment due to the range of unknown variables associated with the processes involved. It is also likely that these processes have already been subject to an environmental assessment within the facilities' established consents.

13.3.14 It is acknowledged that the use of material assets and the generation and management of waste would be likely to generate adverse environmental effects through the transportation of materials and waste (both to site and from site), such as effects on air quality and increased local noise levels. However, these effects are more logically dealt with within other chapters of this Environmental Statement, namely Chapter 11 Air Quality, Chapter 12 Noise and Vibration and Chapter 14 Population and Human Health, and have, therefore, not been included within the scope of this assessment. The assessment has not considered the effects of contaminated land (such as impact on groundwater and human health), as this has been considered within Chapter 6 Geology and Soils. Where the potential for hazardous waste from contaminated land is identified, this chapter addresses the management of this waste.

13.3.15 At the time of writing this chapter, estimates of the quantity of materials required and potential waste arisings from the construction of the Scheme, based on latest information within the Bill of Quantities (BoQ) (dated 1 October 2024), have been used to estimate and assess the material assets required. These estimates are likely to be refined and subject to change as the Scheme design progresses. For that reason, the estimates have been made on a reasonable worst-case scenario basis, informed by professional judgement.

13.3.16 The procurement strategy for the material assets required for the construction of the Scheme is unknown at this stage. For the purposes of the assessment, it will be assumed that not all material assets will be available to be sourced regionally (within Wales), and that the majority will be sourced nationally (within the UK). This will represent the (environmentally) worst case scenario. It is also assumed that all aggregate material sourced either regionally or nationally will meet the regional target for the recycled and secondary aggregate where technically appropriate and economically feasible.

13.3.17 Field surveys were not required for the assessment of material assets and waste management. Baseline information and potential impacts identified are based on publicly available information.

13.3.18 Information on permitted capacity of waste management facilities has been used in the assessment, based on current publicly available data at the time of writing. However, it should be noted that the capacity information obtained from Natural Resources Wales for the sites and regions identified does not necessarily mean that the capacity detailed will be available for use by the Scheme.

13.3.19 It is noted that any future changes to the permitted capacity and throughput are uncertain. It is also difficult to assess the available capacity due to the commercial sensitivity of existing contracts and the timescales over which waste will be produced. It is likely that additional capacity will become available. However, it is not currently possible to predict the timeframes for when these new waste management facilities will become available and, therefore, how many of these sites will be available to accommodate waste arisings from the Scheme. Similarly, it is also possible that some of the existing waste management facilities might be closed or be unavailable.

13.3.20 The assessment has not considered waste and material types and quantities for the decommissioning or amendments of the Scheme at the end of its lifetime, as decommissioning is not envisaged. This ES assesses the decommissioning of the existing bridge which this Scheme is replacing.

13.3.21 It is assumed that the Scheme will aim to minimise the generation of waste and that, in the worst-case scenario, all waste identified for disposal will be sent to landfill. It is assumed that all acceptable excavated topsoil will be re-used in landscaping activities, e.g. within or near the Scheme.

13.3.22 Based on professional judgment, it is assumed that, as a worst-case scenario, 5% of material assets required for the construction of the Scheme that is brought to the site, will become waste due to damages, off-cuts or surplus to requirements.

13.3.23 The old road pavement would be recycled. It is possible to retain the old road in-situ. However, it is likely that the wearing course and compacted sub-base would be removed to facilitate drainage.

13.3.24 When distances from the Scheme were required, these have been measured from postcode CH5 2TF.

13.4 Baseline Conditions

Baseline sources

13.4.1 Baseline information and data were gathered from the following publicly available sources for material assets:

a) Profile of the UK Mineral Products Industry 2023, Mineral Products Association (MPA)[30].

b) United Kingdom Minerals Yearbook 2023, British Geological Survey (BGS)[31].

c) Apparent steel use (finished steel products) 2023, World Steel Association[32].

d) Regional Technical Statement (Second Review, 2019) of the North and South Wales Regional Aggregates Working Party[33].

e) Regional Technical Statement Appendix A (North Wales, Second Review, 2020) of the North Wales Regional Aggregates Working Party[34].

f) BGS: Collation of the results of the 2019 Aggregate Minerals Survey for England and Wales[35].

a) Annual Report 2021, North Wales Regional Aggregates Working Party[36]

[30] Mineral Products Association (2023) Profile of the UK Mineral Products Industry [online]. Available at: https://mineralproducts.org/MPA/media/root/Publications/2023/Profile_of_the_UK_Mineral_Products_Industry_2023.pdf. Last accessed January 2025.
[31] British Geological Survey (2024) UK Minerals Yearbook 2023 [online]. Available at: https://www.bgs.ac.uk/news/uk-minerals-yearbook-2023-now-available-to-download/. Last accessed January 2025.
[32] World Steel Association (2024) Apparent steel use (finished steel products) – World total 2023 [online]. Available at: https://worldsteel.org/data/annual-production-steel-data/?ind=C_asu_fsp_pub/GBR. Last accessed January 2025.
[33] North and South Wales Regional Aggregates Working Party (2019) Regional Technical Statements [online]. Available at: http://www.nwrawp-wales.org.uk/html/rtsreview2019/English/RTS%202nd%20Review%20-%20Main%20Document%20-%20CONSULTATION%20version%20(English).pdf. Accessed January 2025
[34] North Wales Regional Aggregates Working Party (2020) Regional Technical Statements Appendix A [online]. Available at: http://www.swrawp-wales.org.uk/Html/RTS%202nd%20Review%20-%20Appendix%20A%20(North%20Wales)%20%20-%20FINAL%20version%20(English).pdf. Last accessed January 2025.
[35] British Geological Survey (2021) Collation of the results of the 2019 Aggregate Minerals Survey for England and Wales. Available online at: https://assets.publishing.service.gov.uk/media/627e67e6d3bf7f053b9b627f/AM2019_National_Collation-Final.pdf. Last accessed January 2025.
[36] North Wales Regional Aggregate Working Party (2024) Annual Report 2021. Available online at: http://www.grhgca-cymru.org.uk/html/publications1/2021_NWaRAWP_Report_Final.pdf. Accessed January 2025.

b) DataMapWales: Peatlands of Wales[37].

c) BGS: North East Wales Aggregate Safeguarding Areas Map[38].

13.4.2 Baseline information and data were gathered from the following publicly available sources for waste generation and management:

a) Natural Resources Wales – Data Interrogator for Waste[39]

b) DataMapWales: Historic Landfill Sites[40]

c) UK statistics on waste, Department of Environment, Food & Rural Affairs (DEFRA)[41].

Baseline conditions for use of material assets

13.4.3 Information on the demand for key construction material assets within the UK and within Wales has been used to provide the baseline for material assets. This information has been determined through a desk-based study.

13.4.4 The baseline conditions for the use of material assets identifies regional (Wales) and/or national (UK) availability of the key construction materials required for the construction of the Scheme, including for the site preparation and construction of the Scheme.

13.4.5 Material assets refers mainly to raw materials, manufactured construction products that can include materials such as pre-cast elements for the construction of structures such as pipework, barriers, lighting and fencing. Aggregates (such as sand, gravel and crushed rock) are the main raw material assets used to make construction products. There are three main sources to obtain these primary materials:

[37] DataMapWales (2022) Peatlands of Wales [online]. Available at: https://datamap.gov.wales/maps/peatlands-of-wales-maps/. Last accessed January 2025.
[38] British Geological Survey (2012) North East Wales Aggregate Safeguarding Map [online]. Available at: https://nora.nerc.ac.uk/id/eprint/20132/1/NE_Wales_FINAL.pdf. Accessed January 2025.
[39] Natural Resources Wales (2023) Waste Data Interrogators [online]. https://naturalresourceswales.sharefile.eu/share/view/sae217ec1e71419c8/fo32643a-bb38-4031-b6a8-ae66a79b848e. Accessed January 2025
[40] DataMapWales (2024) Historic Landfill Sites [online]. Available at: https://datamap.gov.wales/maps/new?layer=inspire-nrw:NRW_Historic_Landfill_Sites#/. Accessed January 2025
[41] Department of Environment, Food & Rural Affairs (2023) UK statistics on waste. Available online at: https://www.gov.uk/government/statistics/uk-waste-data/uk-statistics-on-waste#recovery-rate-from-non-hazardous-construction-and-demolition-cd-waste. Accessed January 2025.

a) Land-won (often referred to as natural or primary aggregates) – these are extracted directly from the ground in quarries or pits.

b) Marine-dredged – these comprise of sand and gravel dredged from the sea floor.

c) Secondary/recycled – secondary aggregates are a by-product from mineral operations or industrial processes, and recycled aggregates are materials produced by treatment of construction and demolition waste.

13.4.6 It is anticipated that aggregates, aggregate-based materials (such as concrete and concrete products), and steel products would be required in the largest quantities for the construction of the Scheme.

13.4.7 The UK primary aggregate production has been steady over recent years, with an estimated production of approximate 185 million tonnes in 2022[31]. Table 13-3 summarises the latest available information for aggregate production in the UK, of which approximate 40 million tonnes were land-won sand and gravel and 127 million tonnes were crushed rocks. Additionally, Wales had an estimated production of 1.9 million tonnes of sand and gravel and 12.7 million tonnes of crushed rocks in 2022[31].

Table 13-3 UK demand of material and mineral/mineral products

Mineral/mineral products	Year of information	UK production (million tonnes)	Source
Aggregates, of which:			
Crushed rocks	2022	127.5	BGS, 2024[31]
Sand and gravel (land-won)	2022	40.3	BGS, 2024[31]
Sand and gravel (marine-won)	2022	18.7	BGS, 2024[31]
Recycled and secondary aggregates*	2021	69.6	MPA, 2023[30]
Cementitious products, of which:			
Cement clinker	2022	7.2	BGS, 2024[31]
Finished cement	2022	8.4	BGS, 2024[31]

Mineral/mineral products	Year of information	UK production (million tonnes)	Source
Ready-mixed concrete	2022	21.1	BGS, 2024[31]
Concrete products	2021	24.8	MPA, 2023[30]
Asphalt	2021	28.3	MPA, 2023[30]
Dimension stone*	2022	1.0	BGS, 2024[31]
China clay	2022	0.7	BGS, 2024[31]
Slag	2021	1.4	MPA, 2023[30]
Apparent steel use, finished steel products	2023	9.1	World Steel Association, 2024[32]

Note: *Data for these materials are for Great Britain only

13.4.8 Table 13-4 presents the production of minerals in Wales and the UK by the end of year 2022, and the available mineral workings by the end of February 2024.

Table 13-4 Wales and UK production of minerals (in million tonnes) and number of mineral workings in Wales

Mineral	UK production in 2022	Wales production in 2022	Number of mineral workings in Wales in 2024
Igneous rock	126.5	12.7	17
Limestone			37
Dolomite			0
Sandstone			19
Sand and gravel (land-won)	40.3	1.9	15

Source: BGS, 2024[31]

13.4.9 The North Wales Regional Aggregates Working Party[34] published, in 2024, provides the demand and sales of aggregates information for the 2021, the latest available information. Table 13-5 shows an outline of the aggregates sales and reserves by the end of 2021 in Flintshire and North Wales.

Table 13-5 Sales and reserves (both in million tonnes) for sand and gravel and crushed rocks in Flintshire and North Wales by the end of 2021

Region	Material	Sales by 2021	3-year average sales	10-year average sales	Existing permitted reserves	Landbank (years)*
Flintshire	Sand and gravel	Not available**	Not available**	Not available**	Not available**	Not available**
	Crushed rocks	3.13	2.90	2.59	87.8	30
North Wales	Sand and gravel	0.78	0.85	0.80	12.4	15
	Crushed rocks	5.49	3.96	4.61	127.9	32

Source: North Wales Regional Aggregates Working Party, 2024[36]

Notes: * Landbank is based on the 3-years average sales. ** Information is not currently available or it is confidential

13.4.10 Wales aspires to maintain a minimum ten year landbank of crushed rock and a minimum seven year landbank for sand and gravel . Government policies require landbanks to be maintained for all primary aggregate minerals, with a required landbank of at least seven years. Aggregate reserve data indicates that North Wales region is anticipated to have sufficient capacity to ensure future provisions of sand and gravel and crushed rocks.

13.4.11 There are currently four mineral sites for sand and gravel within Flintshire County Council, of which three are active. Additionally, this county has six mineral sites for limestone (crushed rock), of which four are active mineral sites. These mineral sites are presented in Table 13-6 with reference distance from the Scheme measured from grid reference: SJ323686 (postcode: CH5 2TF).

Table 13-6 Mineral sites for sand and gravel and crushed rock within Flintshire County Council

Site name	Mineral type	Status	Approximate distance from the Scheme (km)
Pant y Pwll Dŵr	Limestone	Active	13.85
Aberdo/Bryn Mawr	Limestone	Active	14.42
Hendre	Limestone	Active	13.18
Cefn Mawr	Limestone	Active	13.29
Maes Mynan	Sand and gravel	Active	20.30
Fron Haul	Sand and gravel	Active	16.73
Ballswood	Sand and gravel	Active	12.60
Grange	Limestone	Inactive/dormant	17.30
Ddol Ucha	Sand and gravel	Inactive/dormant	18.35
Pant	Limestone	Inactive/dormant	12.50

Source: North Wales Regional Aggregates Working Party, 2024[36]

13.4.12 Recycled aggregates are derived from reprocessing materials previously used in construction. Examples include recycled concrete from C&D waste, power station ash and asphalt road planings. Secondary Aggregates are usually by-products of other industrial processes not previously used in construction. The Welsh target for both commercial and industrial waste reuse and recycling is set at 70%[19].

13.4.13 Based on information from BGS for Northeast Wales, there are no MSA located within 500m of the Scheme[38]. There are no peat resources within 500m of the Scheme[37]. Baseline information indicates that none of the active mineral sites listed in Table 13-6 within Flintshire County Council are within 500m of the Scheme extents.

Baseline conditions for waste generation and management

Generation and management of waste

13.4.14 Information on the current waste arisings and the capacity of waste management infrastructure in North Wales region, and where possible Flintshire, has been determined through a desk-based study to provide the baseline for this assessment.

Information for the UK, where available, has also been provided as a national comparison. Data was obtained from readily available resources, in particular from the Natural Resources Wales, Welsh Government and Flintshire County Council.

Waste generation in Wales

13.4.15 The latest data from the Natural Resources Wales indicated that Wales produced over 13 million tonnes of waste in 2023. According to Natural Resources Wales[42], as of 2021, there are a total of 729 permitted waste facilities. The permitted waste facilities in North Wales region received over 3.2 million tonnes of waste in 2021, and those in Flintshire received approximately 1.26 million tonnes, as shown in the Table 13-7.

Table 13-7 Waste breakdown by site in tonnes (2023)

Site type	Flintshire (tonnes)	North Wales (tonnes)	Wales (tonnes)
Landfill	82.88	251,985.47	1,042,650.22
Transfer	365,923.93	987,397.24	2,673,054.59
Treatment (excl metal recycling)	255,539.07	805,452.92	6,003,215.38
Metal recovery	39,926.74	126,481.78	1,434,221.35
Incineration	430,762.37	435,943.47	1,100,708.42
Land disposal	139,694.08	154,825.71	160,100.71
Total	1,264,046.85	3,254,684.44	13,032,507.00

Source: NRW[39] Note: Mining, mobile plant, processing, and storage of waste are included in the total waste breakdown

Construction and demolition waste

13.4.16 Natural Resources Wales Waste Permit Returns Data Interrogator (WPRDI)[43] recorded that approximately 3.5million tonnes of inert construction and demolition (C&D) waste were received in permitted waste facilities in the Wales region in 2023, of which over a million were received in North Wales and 447,000 tonnes were received

[42] Natural Resources Wales (2021) Annual Regulation Report. Available online at: https://naturalresources.wales/about-us/how-we-are-performing/annual-regulation-report-2021/?lang=en#:~:text=Waste%20operations,552%20operational%20sites%20in%20Wales. Accessed February 2024
[43] Natural Resources Wales (2024) Waste Permit Returns Data Interrogator. Available online at:https://datamap.gov.wales/documents/2619. Accessed February 2025

in Flintshire. The WPRDI states that approximately 5.5million tonnes of inert C&D waste were removed from permitted waste facilities in Wales with about 1.3million tonnes removed from North Wales and over 500,000tonnes removed from Flintshire.

13.4.17 According to Defra[41], the recovery rate of non-hazardous C&D waste in 2020 across England and Wales was 92.6%. According to Natural Resources Wales[44], the recovery rate of non- hazardous C&D waste in Wales in 2019 was 93%, above the 90% target.

Hazardous waste

13.4.18 Regarding hazardous waste, Table 13-8 summarises the quantities received in 2023 in Wales, North Wales region and Flintshire. A total of 1,822,579.55 tonnes of hazardous waste were received in Flintshire. All wastes presented are C&D wastes.

Table 13-8 Treatment of hazardous waste in tonnes in 2023

Site type	Flintshire (tonnes)	North Wales (tonnes)	Wales (tonnes)
Landfill	0	0	30.85
Transfer	127.22	767.51	21,376.684
Treatment	0	18.00	1,751,100.69
Metal recovery	10,169.40	36,821.50	25.99
Incineration	58,134.35	58,134.35	50,045.34
Total	68,430.97	95,741.36	1,822,579.55

Source: NRW[43] Note: Mining, mobile plant, processing, and storage of waste are included in the total waste breakdown.

Potentially hazardous waste arisings

13.4.19 To identify potential sources of contamination, an initial review of authorised and historic landfill sites that are in close proximity to the Scheme was undertaken using

[44] Natural Resources Wales (2022) Wales Construction & Demolition Waste Arisings Survey. Available online at: https://naturalresources.wales/media/694993/cd-2019-survey-web-accessible-final-003.pdfAccessed February 2025.

DataMapWales web map[40] for historic landfills, and Natural Resources Wales permitted waste sites map for current landfills[45].

13.4.20 There are no historic or current landfills within 500m of the Scheme. Potential sources of contamination that are greater than 500m away from the Scheme have not been considered as these are considered unlikely to affect the Scheme.

Waste management facilities.

13.4.21 NRW reported that in 2021, there are a total of 729 permitted waste facilities [42]. As of 2019 there are only 19 active landfills remaining in Wales, one of which is in Flintshire[46]. The remaining landfill capacity within Wales in 2018 has been stated in Table 13-9 and is the latest available information.

Table 13-9 Estimated landfill void in Wales (2018)

Site type	North Wales (tonnes)	Wales (tonnes)
Hazardous	0	13,868
Non-Hazardous	2,434,154	8,287,452
Inert	1,014,676	1,840,552
Total	**3,448,830**	**10,141,872**

Source: Natural Resources Wales [46]

13.4.22 A search on the Natural Resources Wales public register was undertaken for all permitted waste facilities within 5km of the Scheme, measured from a central point within the Scheme Red Line Boundary extents. These are listed in Table 13-10. There are 11 permitted waste sites within a 5km radius of the Scheme.

13.4.23 Not all treatment facilities may be suitable for the waste generated by the Scheme during construction, but it demonstrates that sufficient treatment facilities are available for the waste that will be generated by the Scheme.

[45] Natural Resources Wales (2024) Find details of permitted sites in Wales Available online at: https://naturalresources.wales/evidence-and-data/maps/find-details-of-permitted-waste-sites/?lang=en. Accessed February 2024.
[46] Natural Resources Wales (2020) Estimated Landfill Void Available online at: https://naturalresourceswales.sharefile.eu/share/view/sb2191ade60e841a99cd356275d22f288/fof469c2-9669-4c96-80a5-a0cf8a41ac35 Accessed February 2025

Table 13-10 Permitted sites within 5km of the Scheme for waste recycling and recovery

Facility name	Facility type	Distance to the Scheme (km)
Chadwicks Metal Processing Facility	Physical treatment infrastructure	0.87
Trident Commercial Holdings Ltd	Physical treatment infrastructure	0.95
J Chadwicks Scrapyard	Physical treatment infrastructure	1.91
Parry and Evans Ltd	Physical treatment infrastructure	2.06
Copart UK – Prince William Avenue	Physical treatment infrastructure	2.38
The Old Transport Yard	Physical treatment infrastructure	2.45
Sea View Farm 1	Disposal infrastructure	2.45
Glasfryn Yard	Physical treatment infrastructure	2.50
Standard Road Transfer Station	Fixed collection infrastructure	4.72
Spencer Ind Est Scrapyard	Physical treatment infrastructure	4.82

Source: Natural Resources Wale[45]

13.4.24 It is expected that the region will have sufficient capacity for waste arisings generated by the Scheme. North Wales has sufficient capacity to treat inert, non-hazardous C&D waste arisings associated with the Scheme.

13.4.25 However, there are no landfills in North Wales that accept hazardous waste. The only permitted site that accepts hazardous waste in Wales is the Tata Steel (Port Talbot) landfill in Southwest Wales. It is likely that, if excavated material is found to be contaminated and, therefore unsuitable for re-use and may potentially be identified as hazardous and requires landfilling, then it will required to be disposed outside the

region. Table 13-11 outlines the operational and permitted landfill sites in the whole of North Wales at the end of 2018, the latest publicly available data.

Table 13-11 Permitted landfill sites in North Wales with remaining capacity at the end of 2018 [45]

Site name	Landfill type	Distance from the scheme (km)	Remaining capacity (m^3)
FCC Environment (Llandullas)	Non hazardous	43.46	167,922
Cory Environmental Central Ltd - Hafod Quarry		98.00	2,218,538
Corus UK Ltd		2.00	47,694
*Sea View Farm		2.77	Not provided
Griffiths Griffith Wyn, Edward Lloyd and Gwenfrai Rees (Ty Mawr Farm)	Inert	25.00	397,791
Clive Hurt (Plant Hire) Ltd		85.00	337,500
Nant Newydd Quarry		84.56	262,500
Treborth Lesuire Ltd.		77.11	16,885

Sources: Natural Resource Wales (2018). Remaining Landfill Void in Wales

*Natural Resource Wales; Find details of permitted waste sites (2025)

13.5 Mitigation Measures Forming Part of the Scheme Design

13.5.1 Measures would be implemented to reduce the effects of material assets use and waste generation and its management by the Scheme during the construction phase. There is substantial overlap in the mitigation for both aspects (material assets use and waste generation and its management), due to the synergy between the reuse of materials and the avoidance of waste generation.

13.5.2 A resource efficiency workshop (D4RE) which covers aspects of circular economy was held on 29 July 2024. The Design for Resource Efficiency (D4RE) Opportunities Matrix (Document reference: 395318-D4RE-001) provides an ongoing record of opportunities identified within the Scheme for more efficient use of material assets, whilst designing out waste, and ensuring designs are sustainable and cost effective. Some opportunities identified from the matrix are highlighted in section 6.5.15. The

matrix utilises the D4RE Tool which assists designers, through workshops (based on a stepped approach of identify, evaluate, capture and implement), to develop mitigation measures for resource and waste management.

13.5.3 Value engineering of the design would continue through the detailed design stage and these changes are captured and recorded in the Opportunities Matrix. This is expected to lead to further material savings.

13.5.4 A Materials Management Plan (MMP) would be compiled by the contractor prior to commencement of site works as part of the construction environment management plan (CEMP). It would identify ways to reuse site-won or excavated materials within the construction of the Scheme, provided they meet the requirements of the CL:AIRE Code of Practice (CoP)[47].

13.5.5 An outline Site Waste Management Plan (SWMP) has been drafted and a full SWMP would be compiled by the contractor as part of the CEMP. It would contain specific information on how waste is managed and disposed of during the construction of the Scheme, as described in Chapter 19 and Appendix 19.

13.5.6 It is recommended that the SWMP includes procedures to prevent the generation of wastes where possible and prioritise re-use or recycling, where applicable, to divert wastes from landfill.

13.5.7 The SWMP within the CEMP would show how efficient use of material assets and reduction of waste arisings would be achieved, and how the potential impacts identified in this chapter would be reduced.

13.5.8 The appointed contractor would continue the registration of the Scheme under the ‘CEEQUAL’ scheme to maintain best practice in reducing the waste generated and in its sustainable management.

13.5.9 Where waste must be taken to a recycling or disposal site, the contractor has a legal duty to ensure that the sites have the appropriate permits. The appointed Contractor

[47] Contaminated Land Applications In Real Environments (CL:AIRE) (2011) The Definition of Waste: Development Industry Code of Practice. Available online at https://www.claire.co.uk/projects-and-initiatives/dow-cop/28-framework-and-guidance/111-dow-cop-main-document Accessed 13/12/18

would identify the closest relevant treatment and disposal sites, to minimise the impacts of transportation.

13.5.10 As a requirement of the contract, waste audits would be undertaken by the contractor throughout the construction phase. The contractor would report on the types and quantities of waste taken off-site, performance against re-use and recycling targets throughout the construction phase and indicate where continual improvements to waste management and minimisation can be made.

13.5.11 In accordance with the NRW GPP5[48], the contactor would ensure that any silt, mud and debris generated during the construction of the Scheme do not affect the watercourse downstream. Effects on the water environment will be covered in more details in Chapter 7:Water Environment

13.5.12 All activities during construction and demolition will be conducted in accordance with NRW GPP 6[49]. This includes the registration of all activities involving the importation of waste with NRW as an exempt/permitted activity.

13.5.13 No material shall be deposited within 10m of watercourses without discussion with NRW.

13.5.14 Any facilities for the storage of oils, fuels or chemicals shall be sited on impermeable surfaces and surrounded by impermeable bund walls. The volume of the bunded compound shall be 110% of the capacity of the tank, all filling points, gauges, vents and sight glasses must be located within the bund. Associated pipework shall be located above ground and protected from accidental damage. All filling points and tank overflow pipe outlets shall be detailed to discharge downwards into the bund, refuelling shall be supervised at all times - and undertaken on an impermeable surface.

13.5.15 Opportunities identified for application to the Scheme taken from the D4RE Opportunity Matrix identified in section 13.5.2 included:

[48] NRW Guidance for Pollution Prevention 5 Works and maintenance in or near water Ver 1.2 February 2018
[49] NRW Guidance for Pollution Prevention 6 Working on construction and demolition sites Ver 1 April 2023

a) Use of a single bridge instead of a dual bridge as a measure to reduce the amount of materials used during construction.

b) Use of existing drainage network within the vicinity of the construction work.

c) In order to minimise the importation of virgin materials, recycled aggregate will be used in secondary non-loading elements of the design. Concrete and blacktop will also be recycled.

d) Reuse of excavated material where this is suitable for re-use.

e) Treatment of excavated clay for use as a higher-grade material.

f) Reduction of cut and fill balance to minimise earthworks.

g) Use of lightweight backfill materials for abutments and embankments.

13.6 Assessment of Land Take Effects

13.6.1 The River Dee and land to the east of the A494, currently in agricultural use, are designated as a Minerals Safeguarding Zone in the FCC UDP (2011)[28] but the likelihood of commercial exploitation of any minerals within the land take of the Scheme is extremely low due to the proximity to the River Dee SAC/SSSI, proximity to the existing A494 embankment and high-grade agricultural land. Land would not be occupied by waste deposits because all waste generated would be removed from the vicinity.

13.6.2 No effects on potential sensitive receptors due to the land take for the Scheme are anticipated.

13.7 Assessment of potential construction effects

13.7.1 This section provides an assessment of potential effects of material assets use and waste generation and its management as a result of the Scheme during its construction. In accordance with DMRB LA110, the construction phase considers site preparation, demolition and site construction.

Use of material assets

13.7.2 Material assets include raw materials such as aggregate and minerals from primary, secondary and recycled sources, and manufactured construction products. Manufactured construction products can include the materials required for the

construction of the road surface, pre-cast elements for the construction of structures such as bridges, gantries and signage, barriers, lighting and fencing.

13.7.3 Road schemes generally require large quantities of both primary raw materials and manufactured construction products. Many material assets may originate off-site, purchased as construction products. However, some materials may arise on-site, for example excavated soils and sub-strata.

13.7.4 The types of material assets likely to be required during the construction phase are (although the list is not exhaustive):

a) Steel.
b) Concrete.
c) Cement.
d) Aggregate based materials.

13.7.5 However, it should be noted other materials such as plastics, timber, and metals for fencing have not been considered as these are prefabricated materials and are likely to be used in negligible quantities in comparison to the bulk construction materials required.

13.7.6 The potential impacts associated with the use of material assets on the receptors include:

a) The availability of material assets and the subsequent impact on the demand for materials. Materials will need to be imported to the site as it is assumed the Scheme will be unlikely to entirely recover or re-use site-won material.
b) The depletion of non-renewable resources. The majority of materials used on the Scheme will comprise primary materials as the Scheme is unlikely to be able to source all required materials from recycled or secondary materials.

13.7.7 It is not anticipated that material assets will be required for site clearance activities such as demolition. If any were required, the quantities of both primary raw materials and manufactured products will be negligible compared to those required for construction works. Therefore, it is anticipated that there will not be any impacts to material assets use relating to the site clearance works.

13.7.8 Similarly, material assets used to produce finished products (such as signage and signalling infrastructure, CCTVs) have not been considered as part of the assessment.

13.7.9 A summary of the material assets required for the construction during various stages/activities of the Scheme is presented in the table below.

Table 13-12 Overview of material assets required for the construction of the Scheme

Scheme activity	Quantity (unit)
Gravel reinforced plastic (GRP)	2886m^3
Timber	3153.8m^2
Metal	198m
Beam safety barrier (class N2)	1430m
Concrete safety barrier (class H2)	883m
Metal vehicle parapet	331m
Pedestrian parapet	155m
Carrier drains pipes	2023m
Gullies	379m
Precast concrete (for culverts)	148.92m^3
General fill	32881m^3
Fill to pavement	1137m^3
Granular fill materials	414m^3
Topsoil	6701m^3
Class 2A/2B/2C Fill material for ponds, swales and open channels	1376m^3
Geomembrane liner (butyl/ ethylene propylene diene monomer (EPDM))	3104m^3
Subbase (cement-bound granular mixture-CBGM)	2963m^3
Base course (asphalt concrete)	4331m^3
Binder course (asphalt concrete)	1418m^3
Surface course (asphalt)	1100m^3
Cold road planing	41m^3
Combined kerb drainage	285m

Linear drainage channel	142m
Precast concrete for kerbs	3497m
Pre cast concrete for edgings	3192m
Type 2 bar retaining wall	55.318t
Mass concrete	109m^3
Reinforced concrete	5154m^3
Surface finish of concrete	1492m^3
Precast concrete for bridge deck	223m^3
Steel reinforcement for structure	1131t
Structural steel	1377t
Spray applied waterproofing	4431m^2
Brickwork	1269m^2
Blockwork	622m^2

Source: BoQ-Cost Plan Dated 1 October 2024.

13.7.10 Based on the material and design requirement presented in Table 13-12, a summary the estimated quantities of material assets required for the construction of the Scheme, taking account of bulk construction materials exclusive of prefabricated materials such as plastic and timber are outlined in Table 13-13.

Table 13-13 Estimated summary of the material assets required for the Scheme

Material	Estimated required quantity	Material availability (million tonnes)	Percentage of available material required by the Scheme
Concrete	7299m^3	21.1	0.083%
Steel	2565tonnes	9.1	0.028%
Aggregate*	42509m^3	40.3	0.184%
Concrete-based materials	9,854m^3	24.8	0.096%

*This is inclusive of aggregate-based asphalt, and source assumed to be land-won. Average density factor for concrete and aggregate assumed to be: 2400kg/m^3 and 1750kg/m^3 respectively.50

[50] Civil Engineering (2025). Available Online at https://civiltoday.com/civil-engineering-materials/concrete/361-density-of-concrete#google_vignette. Accessed February 2025

13.7.11 It is likely the contractor would consider the proximity to the site and haulage costs of bulk materials, such as construction fill, to reduce cost whereas the selection of suppliers for more specialist materials, such as steel beams, would depend on quality and availability from suitable suppliers.

13.7.12 The majority of the materials required for the construction of the Scheme will consist of aggregate, concrete and surfacing (which are aggregate-based products). The recycled content of this material that could be used in the Scheme is unknown at this stage. Best practice would be to use materials with a high proportion of sustainable features and benefits compared to industry-standard materials where it is technically appropriate and economically feasible to do so.

13.7.13 Table 13-14 provides indicative figures for the earthwork volumes balance for the construction of the Scheme.

Table 13-14 Estimated cut and fill balance for the Scheme

Earthwork activity	Quantity (m^3)	Quantity (tonnes)	Additional notes
Cut	4,973	8,554	In line with the Welsh national requirements, 70% of cut materials are expected to be re-used during construction.
Fill	32,880	56,554	Depending on the quantity of cut material re-used on the site, it is expected that 29400m^3 (50566 tonnes) of fill material will require importation for the Scheme.

Source: BoQ-Cost Plan Dated 1 October 2024.

13.7.14 The volume of excavated materials to be re-used on the Scheme is yet to be specified at the time of writing. However, it is assumed this will be in line with the national requirement (which sets a target of 70% re-use)[19]. In addition to the volume of materials re-used, the volumes of imported construction fill would also depend on the characteristics of the existing ground and the subsequent carriageway design.

13.7.15 Taking account of the national target, a total of 3,280m^3 of cut material will be re-used. Therefore 29,600m^3 of total fill materials will be imported.

13.7.16 It is anticipated that there would be a direct and permanent effect on the availability of material assets and in the depletion of non-renewable resources, due to the use of material assets during the construction phase.

13.7.17 Backfill to structures would be imported to site as material meeting the required specification is not expected to be won from the site. In addition, it is unlikely that suitable materials for the road construction, such as capping material and sub-base, would not be available from site-won material and so these would need to be imported.

13.7.18 Structures that would need to be built as part of the Scheme are listed in the Construction Phasing and Buildability report and summarised in ES Chapter 2.

13.7.19 Elements such as steel for structures and barriers, lighting columns and ducts, signs and communications infrastructure would require importing to site.

13.7.20 The detailed assessment of the effects on material assets can be seen in Table 13-15.

Table 13-15 Assessment of effects on material assets

Project activity	Potential impacts associated with material assets use	Description of the impacts and significance of residual effect
Site construction (including earthworks)	Material assets are imported on-site as the Scheme is unlikely to recover/reuse site-won material.	The implementation of mitigation measures as outlined in section 6.5 would ensure the efficient use of material assets on site. Seventy percent of site-won materials are expected to be re-used onsite. As Flintshire produces large quantities of primary and secondary aggregate, it is assumed that less than 50% would need to be sourced outside the region i.e. nationally, and other primary materials would be obtained locally. Effects would be direct, permanent and adverse. Effect category: **Slight Adverse** Significance of effect: **Not Significant**

Project activity	Potential impacts associated with material assets use	Description of the impacts and significance of residual effect
	Majority of material assets used on the Scheme comprise of primary material as the Scheme is unlikely to use recycled/secondary material assets.	The baseline study (section 6.4) has indicated adequate supply of aggregates within Flintshire, and the use of the available aggregate by the proposed Scheme is anticipated to be approximately less than 1%. With the implementation of the design and mitigation measures outlined in section 6.5, it is anticipated that where site won material is not available for re-use, and where technically appropriate and economically feasible, material assets with recycled content would be considered to be used within the Scheme to support the Welsh Government's Beyond Recycling strategy to makes Wales a zero-waste nation by 2050. Effects would be direct, permanent and adverse, but not significant. Effect category: **Slight Adverse** Significance of effect: **Not Significant**

Generation and management of waste

13.7.21 During the construction phase, the Scheme has the potential to generate waste which may result in adverse environmental effects. However, the Scheme aims to minimise the generation of waste as much as possible, through the implementation of the waste hierarchy and through Scheme-specific measures earlier highlighted in section 13.5.

13.7.22 Waste is likely to arise predominantly from activities such as excavation of natural and 'made' ground and demolition of existing structures, and from materials brought to the site that are not used for their intended purpose such as damaged items and cut offs.

13.7.23 The receptors likely to be subject to impacts as a result of waste generation and its management are the surrounding environment and habitats, landfills and other waste management infrastructure. The potential impacts relating to the generation and management of waste on these receptors include:

a) Temporary occupation of waste management infrastructure capacity (from treatment of waste) and temporary occupation of land for the storage of waste awaiting transfer offsite.

b) Permanent reduction in landfill capacity (from disposal of waste).

13.7.24 The amount of waste that will arise during the construction of the Scheme will be subject to change as the construction progresses, and on the efficiency achieved by the contractor. It is assumed that all waste will be managed according to the SWMP and the waste hierarchy. It is assumed that 5% of imported materials would be expected to end up as waste. Based on the total quantity of import material as stated in Table 13-13, this equates to 1480m^3 volume of waste. This assumption has been based on professional judgement and experience on other schemes. Additionally, it is anticipated that 70% of excavated material will be re-used on site for non-structural works, such as bunding and landscaping, and therefore will not be disposed in landfill.

13.7.25 Table 13-15 outlines the waste streams that are likely to be generated by the construction of the Scheme with waste types, where stated, informed from the Scheme BoQ; Table 13-16 summarises the estimated reduction in Wales' landfill void capacities.

Table 13-16 Anticipated waste arisings

Scheme activity	Waste arisings from the Scheme	Quantities of waste arisings	Additional information on waste arisings
Demolition	Breakdown of existing bridge structure, properties and redundant pumping station waste mainly consisting of concrete	4,136m^3	Demolition would be phased – the existing A494 river bridge would be demolished after all

Scheme activity	Waste arisings from the Scheme	Quantities of waste arisings	Additional information on waste arisings
	Existing pavement including subbase and bedding material	2033m^3	traffic is transferred to the new river bridge.
Excavation	Topsoil, abutments, river pier pile caps, retaining walls, culverts, and excavation within ponds and open channels where required	17,819m^3 (5,268m^3 is expected to be topsoil, 10,040m^3 inert and 2,510m^3 non-hazardous waste).	This is based on the assumption that the Scheme will follow government target for materials re-use, given the uncertainty of the proportion to be re-used onsite at the time of writing. Waste arisings would be managed by the Contractor as part of a SWMP in accordance with the waste hierarchy.
Construction activities	A proportion of imported materials arising from damaged materials/off cuts. Small volumes of municipal solid waste generated from temporary construction compounds.	1480m^3	Waste would be minimised as far as possible through re-use on-site and would be managed by the Contractor as part of a SWMP.

Note: Except where specified, all waste arisings are assumed to be inert wastes.

13.7.26 Excavated material that could be contaminated and potentially hazardous has not been identified for the Scheme. The volume of hazardous waste that may be generated by the Scheme is currently unknown. It is unlikely that hazardous waste will arise from the Scheme and hence the effects are Neutral and not significant.

Table 13-17 Estimated reduction of Wales' landfill capacities

Site Type of landfill	Quantity of waste from the Scheme (m3)	Quantity of waste from the Scheme (tonnes)	Estimated reduction of landfill capacity
Inert	5010	1603	0.3%
Non-Hazardous	2510	803	0.01%
Hazardous	Not quantified	Not quantified	None anticipated

A density factor of 0.32tonnes/m3 have been assumed to obtain quantities in tonnes[51]

13.7.27 The assessment of the effects of the generation and management of waste can be seen in Table 13-17.

Table 13-18 Assessment of effect of the waste arisings

Potential effect	Description of effects	Significance of effect	Environmental effect
Generation of inert waste resulting in the temporary occupation of waste management infrastructure capacity or permanent reduction in landfill capacity	It is estimated that the Scheme will reduce the capacity of inert landfills within Wales by 0.3%	Slight	Not significant
Generation of non-hazardous waste resulting in the temporary occupation of waste management infrastructure capacity or permanent reduction in landfill capacity	It is estimated that the Scheme will reduce the capacity of non-hazardous landfills within Wales by 0.01%	Slight	Not significant

[51] Environment Agency . UK density conversion factors for waste. Available online at: https://www.sepa.org.uk/media/163323/uk-conversion-factors-for-waste.xlsx. Accessed February 2025

Potential effect	Description of effects	Significance of effect	Environmental effect
Generation of hazardous waste resulting in the temporary occupation of waste management infrastructure capacity or permanent reduction in landfill capacity	No landfill sites exist within 500m of the Scheme that may give rise to hazardous excavated waste. Available data from the BoQ and design information at the time of assessment did not indicate the likelihood of hazardous waste arising from the Scheme. However, if encountered from demolition of existing bridge or other areas within the Study area, this is expected to be in a negligible quantity.	Slight	Not significant

13.8 Additional Mitigation and Monitoring

13.8.1 No additional mitigation is required for material assets and generation and management of waste as effects are not significant.

Design measures

13.8.2 No further design measures other than those highlighted in section 6.5 will be required for the Scheme.

13.8.3 There is potential for hazardous waste to arise during excavation for the new pumping station. If contaminated material is encountered during construction and has to be removed, contaminated waste arisings would be managed in accordance with the SWMP, treated or disposed of accordingly.

Monitoring

13.8.4 Inspections and maintenance would limit the rate of structure deterioration and reduce the quantity of construction or paint material entering the environment over the long term.

13.8.5 No significant effects on material assets or on inert landfill capacity from the Scheme are anticipated. The SWMP would include monitoring to avoid the generation of waste where possible and prioritise the re-use or recycling of waste to divert from landfill. No additional monitoring is proposed.

13.9 Assessment of land take effects with additional mitigation

13.9.1 There is no specific mitigation available for land take effects and so no change to the effects are assessed.

13.10 Assessment of Construction effects with additional mitigation

13.10.1 No further assessment of construction effects are required other than that discussed in section 13.7

13.11 Assessment of Cumulative Effects

13.11.1 The quantities of material required for the Scheme are a relatively small proportion of the demand across Flintshire (the second study area). Therefore, it is unlikely the demand would affect supplies for other projects in the region during the same period as this Scheme. Furthermore, demolition of existing structures would provide resources to the Region, partly compensating for new materials to be used in the construction of the Scheme.

13.11.2 Waste generated during construction would not significantly interact with other developments within the second study area because the waste would be either re-used, recycled or recovered on site or removed from the site for disposal. Waste, largely inert, taken off-site for disposal would use the same facilities and capacity as other developments in the second study area of Flintshire. This would have a small effect on the limited remaining capacity of Flintshire's inert waste operations, since the quantities disposed of in this way would be small.

13.11.3 There are no significant cumulative effects within the first and second study areas (Scheme footprint and Flintshire) arising from material and waste resources management for the Scheme.

13.11.4 Any cumulative effects of the Scheme, in conjunction with other proposed developments, will be assessed and presented in Chapter 17: Cumulative Effects. The major development considered for the cumulative effects assessment is the Northern Gateway project which is a mixed used development located within 1km distance to the Scheme.

Inter-relationships

13.11.5 The assessment of the management of waste is inter-related with the assessment of impacts set out in Chapter 6 Geology and Soils, in Chapter 7 Water Environment. Chapter 8 Biodiversity, and Chapter 11 Air Quality. The likely presence of contaminated materials is set out in Chapter 6; the risks to the water environment from contaminated and other waste materials are described in Chapter 7, and the consequences of pollution from these sources are noted in Chapter 8. Climate Change and Greenhouse Gas Emissions as set out in Chapter 15, takes into account the carbon emissions associated with the construction of the Scheme, including those arising from the production and transportation of materials and waste.

13.11.6 During the construction phase, materials and waste would be present close to the road drainage system linked to the River Dee, with potential for run off which could have ecological impacts on species and habitats and on water quality. Working methods to adequately manage and limit these risks are set out in Chapter 18 Environmental Management and consequently are not considered to be significant.

13.12 Summary of Residual Effects

13.12.1 The environmental effects for material assets and waste are not significant and will remain the same as those reported in section 13.7. therefore, there are no residual significant effects associated with material assets and waste.

Llywodraeth Cymru / Welsh Government

A494 RIVER DEE BRIDGE REPLACEMENT SCHEME

Environmental Statement

Volume 1: Technical Assessment Report

Chapter 14: Population and Human Health

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14. Population and Human Health

14.1 Introduction

14.1.1 This Chapter presents the information required by the Infrastructure Planning (Environmental Impact Assessment (EIA)) Regulations 2017 (as amended) to be provided in the Environmental Statement (ES) to enable the identification and assessment of likely significant effects on the population and human health.

14.1.2 The assessment has been undertaken in accordance with Design Manual for Roads and Bridges (DMRB)[1] – LA 112 Population and Human Health Revision 1 (DMRB LA 112) and IEMA guidance for the construction and operational phases of the proposed Scheme.

14.1.3 It provides an overview of the population and human health baseline within the study area and details the likely significant community and health effects that may result from the proposed Scheme. It also sets out the proposed approach for assessing the impact of the Scheme on population and human health.

14.1.4 This assessment will consider land use, accessibility and human health, and should be read as part of the wider EIA, when completed, with particular reference to:

- Chapter 6: Geology and soils
- Chapter 9: Landscape and visual
- Chapter 11: Air quality
- Chapter 12: Noise and vibration

14.2 Legislation and Policy Framework

National Policy

Countryside and Rights of Way Act, 2000:

14.2.1 The Countryside and Rights of Way Act 2000[1] represents the main legal framework governing the public footpaths, bridleways, traffic and restricted byways. The first two parts of the Act are relevant to this assessment:

- Part 1 Access recognises the right of access to mountain, moor, health, down and registered common land. It also recognises the needs of landowners and managers.
- Part 2 Rights of Way of the Act requires local authorities to review and publish plans for improving rights of way in their areas, considering the needs of the public including disabled people. The section of the Act also outlines the mechanism to divert public rights of way (PRoW) temporarily and permanently.

Equality Act, 2010:

14.2.2 The Equality Act 2010[2] requires decision making to have due regard to the need to remove discrimination and support equality of opportunity for a range of 'protected characteristic' groups. This is further considered within the Equality Impact Assessment (EqIA) for the Scheme.

Well-being of Future Generations (Wales) Act, 2015:

14.2.3 The Well-being of Future Generations (Wales) Act[3] aims to improve the social, economic, environmental and cultural well-being of Wales. The Act includes seven legally binding well-being goals for national government, local government, local health boards and other specified public bodies. It

[1] Gov.uk (2000): The Countryside and Rights of Way Act 2000. Available at: https://www.legislation.gov.uk/ukpga/2000/37/contents
[2] Gov.uk. (2010): 'The Equality Act'. Available at: https://www.legislation.gov.uk/ukpga/2010/15/contents
[3] Llywodraeth Cymru Welsh Government. (2015): 'Well-being of Future Generation (Wales) Act 2015: The Essentials'. Available at: https://www.gov.wales/sites/default/files/pdf-versions/2025/2/2/1740501518/well-being-future-generations-act-essentials.pdf

details the ways in which specified public bodies must work to improve the well-being of Wales. The seven well-being goals are set out below:

- A prosperous Wales
- A resilient Wales
- A healthier Wales
- A more equal Wales
- A Wales of cohesive communities
- A Wales of vibrant culture and thriving Welsh language
- A globally responsible Wales

14.2.4 The Act places a well-being duty on which public bodies are expected to carry out when undertaking development. This well-being duty includes the following steps:

- Setting and publishing objectives ("well-being objectives") that are designed to maximise its contribution to achieving each of the well-being goals.
- Taking all reasonable steps (in exercising its functions) to meet those objectives.

Planning Policy Wales, 2024:

14.2.5 The Planning Policy Wales (PPW)[4] outlines various planning policies set out by the Welsh Government, with the primary objective of ensuring that the planning system for a major development contributes towards the delivery of sustainable development and improves the social, economic, environmental and cultural well-being of Wales. The PPW contains the following polices relevant to the Scheme:

- Policy 4.1: Transport: The policy states that the planning system in Wales should enable people to access jobs and services through shorter, more efficient and sustainable journeys, by walking, cycling and public transport.

[4] Llywodraeth Cymru Welsh Government (2024): 'Planning Policy Wales'. Available at: https://www.gov.wales/sites/default/files/publications/2024-07/planning-policy-wales-edition-12.pdf

- Policy 5.3: Transport Infrastructure: The policy states that development plans should specify the primary road network, including trunk roads, and separately identify the core network. These routes should be identified on the constraints map as corridors for movement adjacent to which development that would compromise this strategic transport role, or adversely affect the environment or people's health, amenity or wellbeing, will be resisted.
- Policy 6.2: Green Infrastructure: Integrating Green Infrastructure and Development: The quality of the built environment should be enhanced by integrating green infrastructure into development through appropriate site selection and use of creative design.
- Policy 6.3: Landscape: The policy states that developments should ensure that landscapes provide opportunities for tourism, outdoor recreation, local employment, renewable energy and the physical and mental health and well-being of local population.
- Policy 6.7: Air Quality and Soundscape: When proposing new strategies for development, the policy states that it is important to avoid instances where incremental development of infrastructure, housing, commercial and industrial development creates or exacerbates health and amenity inequalities by introducing more sensitive receptors into an area or by making existing occupiers more vulnerable to poor air quality or noise.

Future Wales: The National Plan 2040

14.2.6 Future Wales: The National Plan 2040[5] provides a framework that sets the direction for development in Wales from 2024 to 2040. The plan is concerned with infrastructure and development in Wales and aims to ensure that the planning system is consistent at all levels.

14.2.7 Within the plan, policies relevant to the Scheme are:

- Policy 11: National Connectivity: The Welsh Government states that it will support and invest in improving national connectivity. Its priorities are to encourage longer distance trips by public transport, while also making longer journeys possible by electric vehicles. To achieve the aims of the policy the Welsh Government will work with Transport for Wales, local authorities, operators and partners to support the delivery of the following measures to improve national connectivity:

[5] Llywodraeth Cymru Welsh Government (2021): 'Future Wales: The National Plan 2040'. Available at: https://www.gov.wales/sites/default/files/publications/2021-02/future-wales-the-national-plan-2040.pdf

- Rail Network: The policy aims to transform the rail network and improve the quality of rail services for passengers.
- Bus Network: The policy aims to invest in the development of the national bus network, achieve full integration with regional and local bus networks, and to increase modal share of bus travel in Wales.
- Strategic Road Network: The policy states that the Welsh Government will increase investment in road improvements, with the aim of reducing journey times, delivering a safer and more resilient road network, and improving air and noise quality.
- National Cycle Network: The policy aims to revitalise the National Cycle Network to create a network of traffic free paths connecting cities, towns and countryside across Wales.

- Policy 12: Regional Connectivity: The policy states that the Welsh Government will aim to support and invest in improving regional connectivity. In urban areas, the priorities are to improve and integrate active travel and public transport. In rural areas the priorities are supporting the uptake of ultralow emission vehicles and diversifying and sustaining local bus services. Policy aims which are relevant to the Scheme are:
  - Active Travel: The policy aims to support the implementation of the Active Travel Act 2013 to create comprehensive networks of local walking and cycling routes that connect places that people need to get to for everyday purposes.
  - Bus: The policy aims to improve the legislative framework for how local bus services are planned and delivered. It states that the Welsh Government will invest in the development of integrated regional and local bus networks to increase modal share of bus travel and improve access by bus to a wider range of trip destinations.
  - Ultra Low Emissions Vehicles: The policy aims to support the rollout of suitable fuelling infrastructure to facilitate the adoption of ultralow emission vehicles, particularly in rural areas.

Regional Policy

North Wales Economic Ambition Board: Growth Deal for North Wales Bid, 2016:

14.2.8 Ambition North Wales[6], an organisation which comprises of six local authorities in the North Wales region, has produced a growth deal to ensure that the region develops sustainably, with opportunities for people to gain new skills for the future and develop rewarding careers. The plan has four key pillars to make promote sustainable development in North Wales:

- Connected: To improve road and transport infrastructure to enhance connectivity for the region's businesses and residents.
- Smart: To develop and promote development projects in the region's keys sectors and infrastructure.
- Resilient: To create employment opportunities and focus on retaining young people in North Wales.
- Sustainable: To protect the environment and to develop the region responsibly.

Local Policy

Flintshire Local Development Plan, 2023:

14.2.9 The Flintshire Local Development Plan[7] identifies the need to promote safe communities, address local housing needs, encourage economic prosperity and implement mitigations for environmental issues. The plan sets out four key themes as part of its strategic priorities, these are:

- Creating sustainable places and communities
- Supporting a prosperous economy
- Meeting housing needs
- Supporting the environment

[6] Uchelgais Gogledd Cymru Ambition North Wales.(2020). 'Growth Deal'. Available at: https://ambitionnorth.wales/
[7] Flintshire County Council (2015): 'Flintshire Local Development Plan'. Available at: https://www.flintshire.gov.uk/en/Resident/Planning/Local-Development-Plan.aspx

14.2.10 Under these themes, policies[8] relevant to the Scheme are:

- Policy STR13: Natural and Built Environment, Green Networks and Infrastructure – encouraging the creation and protection of green space, open space and play environments that encourage and support good health, well-being and equality in access.
- Policy PC6: Active Travel – ensuring that people have access to employment, education, healthcare and other essential services through the provision of public walking and cycle routes.
- Policy PC12: Community Facilities – encouraging the development of new education, health and community facilities on suitable sites.

14.3 Assessment Methodology

14.3.1 The approach used to undertake the population and human health assessment comprises of two methodologies – one for land use and accessibility (using DMRB LA 112 guidance) and another for human health (using IEMA). The use of two methodologies is due to limitations of each respective methodology. DMRB LA 112 does not provide a framework for assigning significance to human health effects. As such, the assessment on human health has been completed in accordance with IEMA's 'Determining Significance for Human Health in Environmental Impact Assessment'[9]. These are described further below.

14.3.2 The assessment has made use of desk-based information available from the Office for National Statistics (ONS), Ordnance Survey (OS) AddressBase, the Welsh Indices of Multiple Deprivation (WIMD), and Flintshire County Council, as well as drawing upon information determined as part of the assessment of other relevant disciplines presented within this ES.

[8] Strategic policies within the Flintshire Local Development Plan are denoted with the prefix 'STR'. Each of the strategic policies is accompanied by relevant detailed policies. Detailed policies have the prefix 'PC'.
[9] Institute of Environmental Management and Assessment (IEMA). (2022). 'Determining significance for Human Health in Environmental Impact Assessment'. Available at: https://www.iema.net/media/yljb2nbs/iema-eia-guide-to-determining-significance-for-human-health-nov-2022.pdf

Land Use and Accessibility

14.3.3 The assessment of land use and accessibility focuses on those impacts that are likely to have significant effects on the community and has been completed in accordance with DMRB LA 112. Significance has been determined by considering the sensitivity of the receptor, as well as the magnitude of the impact on those receptors.

14.3.4 The following receptors are included in the assessment, as defined in DMRB LA 112:

- Private Property and Housing
- Community Land and Assets
- Development Land and Businesses
- Agricultural Land Holdings
- Walkers, Cyclists and Horse riders (WCH)

Sensitivity

14.3.5 Table 14-1 below sets out criteria that have been used to describe and assess the sensitivity of receptors, as outlined in DMRB LA 112.

Table 14-1 Sensitivity of Receptors

Sensitivity	Criteria
Very high	Private property and housing: • Existing private property or land allocated for housing located in a local authority area where the number of households are expected to increase by >25% by 2041 (ONS data). • Existing housing and land allocated for housing (e.g. strategic housing sites) covering >5ha and/or >150 houses. Community land and assets where there is a combination of the following: • Complete severance between communities and their land/assets, with little/no accessibility provision • Alternatives are only available outside the local planning authority area.

	• The level of use is very frequent (daily). • The land and assets are used by the majority (>=50%) of the community. Development land and businesses: • Existing employment sites (excluding agriculture) and land allocated for employment (e.g. strategic employment sites) covering >5ha. Agricultural land holdings: • Areas of land in which the enterprise is wholly reliant on the spatial relationship of land to key agricultural infrastructure. • Access between land and key agricultural infrastructure is required on a frequent basis (daily). WCH: • National trails and routes likely to be used for both commuting and recreation that record frequent (daily) use. Such routes connect communities with employment land uses and other services with a direct and convenient WCH route. Little / no potential for substitution. • Routes regularly used by vulnerable travellers such as the elderly, school children and people with disabilities, who could be disproportionately affected by small changes in the baseline due to potentially different needs. • Rights of way for WCH crossing roads at-grade with >16,000 vehicles per day.
High	Private property and housing: • Private property or land allocated for housing located in a local planning authority area where the number of households are expected to increase by 16-25% by 2041 (ONS data). • Existing housing and land allocated for housing (e.g. strategic housing sites) covering >1-5ha and / or >30-150 houses. Community land and assets where there is a combination of the following: • There is substantial severance between community and assets, with limited accessibility provision. • Alternative facilities are only available in the wider local planning authority area. • The level of use is frequent (weekly). • The land and assets are used by the majority (>=50%) of the community.

	Development land and businesses: • Existing employment sites (excluding agriculture) and land allocated for employment (e.g. strategic employment sites) covering >1 - 5ha. Agricultural land holdings: • Areas of land in which the enterprise is dependent on the spatial relationship of land to key agricultural infrastructure. • Access between land and key agricultural infrastructure is required on a frequent basis (weekly). WCH: • Regional trails and routes (e.g. promoted circular walks) likely to be used for recreation and to a lesser extent commuting, that record frequent (daily) use. Limited potential for substitution. • Rights of way for WCH crossing roads at-grade with >8,000 - 16,000 vehicles per day.
Medium	Private property and housing: • Houses or land allocated for housing located in a Local Authority area where the number of households are expected to increase by >6-15% by 2041 (ONS data). • Existing housing and land allocated for housing (e.g. strategic housing sites) covering <1ha and / or <30 houses. Community land and assets where there is a combination of the following: • There is severance between communities and their land/assets but with existing accessibility provision. • Limited alternative facilities are available at a local level within adjacent communities. • The level of use is reasonably frequent (monthly). • The land and assets are used by the majority (>=50%) of the community. Development land and businesses: • Existing employment sites (excluding agriculture) and land allocated for employment (e.g. strategic employment sites) covering <1ha. Agricultural land holdings:

	• Areas of land in which the enterprise is partially dependent on the spatial relationship of land to key agricultural infrastructure. • Access between land and key agricultural infrastructure is required on a reasonably frequent basis (monthly). WCH: • Public Rights of Way and other routes close to communities which are used for recreational purposes (e.g. dog walking), but for which alternative routes can be taken. These routes are likely to link to a wider network of routes to provide options for longer, recreational journeys. • Rights of way for WCH crossing roads at-grade with >4,000 – 8,000 vehicles per day.
Low	Private property and housing: • Proposed development on unallocated sites providing housing with planning permission/in the planning process. Community land and assets where there is a combination of the following: • Limited existing severance between community and assets, with existing Equality Act 2010 compliant accessibility provision. • Alternative facilities are available at a local level within the wider community • The level of use is infrequent (monthly or less frequent). • The land and assets are used by the minority (>=50%) of the community. Development land and businesses: • Proposed development on unallocated sites providing employment with planning permission / in the planning process. Agricultural land holdings: • Areas of land which the enterprise is not dependent on the spatial relationship of land to key agricultural infrastructure. • Access between land and key agricultural infrastructure is required on an infrequent basis (monthly or less frequent). WCH: • Routes which have fallen into disuse through past severance or which are scarcely used because they do not currently offer a meaningful route for either utility or recreational purposes.

	• Rights of way for WCH crossing roads at-grade with <4,000 vehicles per day.
Negligible	Private property and housing: • N/A Community land and assets where there is a combination of the following: • No or limited severance or accessibility issues • Alternative facilities are available within the same community. • The level of use is very infrequent (a few occasions yearly). • The land and assets are used by the minority (>=50%) of the community. Development land and businesses: • N/A Agricultural land holdings: • Areas of land which are infrequently used on a non-commercial basis WCH: • N/A

Source: MRB LA 112 Population and human health, Revision 1, Table 11 Environmental value (sensitivity) and descriptions.

Magnitude

14.3.6 Table 14-2 below sets out criteria that have been used to describe and assess the magnitude of impact on community and health receptors, as outlined in DMRB LA 112.

Table 14-2 Magnitude of Impacts

Magnitude	Criteria
Major	Private property and housing, community land and assets, development land and businesses and agricultural land holdings: • Loss of resource and/or quality and integrity of resource; severe damage to key characteristics, features or elements. e.g. direct acquisition and demolition of buildings and direct development of land to accommodate highway assets. • Introduction (adverse) or removal (beneficial) of complete severance with no/full accessibility provision. WCH:

	• >500m increase (adverse) / decrease (beneficial) in WCH journey length.
Moderate	Private property and housing, community land and assets, development land and businesses and agricultural land holdings: • Partial loss of / damage to key characteristics, features or elements, e.g. partial removal or substantial amendment to access or acquisition of land compromising viability of property, businesses, community assets or agricultural holdings. • Introduction (adverse) or removal (beneficial) of severe severance with limited / moderate accessibility provision. WCH: • >250m - 500m increase (adverse) or decrease (beneficial) in WCH journey length.
Minor	Private property and housing, community land and assets, development land and businesses and agricultural land holdings: • A discernible change in attributes, quality or vulnerability; minor loss of, or alteration to, one (maybe more) key characteristic, features or elements, e.g. amendment to access or acquisition of land resulting in changes to operating conditions that do not compromise overall viability of property, businesses, community assets or agricultural holdings. • Introduction (adverse) or removal (beneficial) of severance with adequate accessibility provision. WCH • >50m - 250m increase (adverse) or decrease (beneficial) in WCH journey length.
Negligible	Private property and housing, community land and assets, development land and businesses and agricultural land holdings: • Very minor loss or detrimental alteration to one or more characteristics, features or elements. e.g. acquisition of non-operational land or buildings not directly affecting the viability of property, businesses, community assets or agricultural holdings. • Very minor introduction (adverse) or removal (beneficial) of severance with ample accessibility provision. WCH • <50m increase (adverse) or decrease (beneficial) in WCH journey length.

No change	• No loss or alteration of characteristics, features, elements or accessibility; no observable impact in either direction.

Source: DMRB LA 112, Revision 1, Table 3.12 Magnitude of impact and typical descriptions

Significance

14.3.7 The significance of effects has been assessed by applying the matrix below, along with professional judgment to consider site specific factors that may be of relevance. Significant effects comprise those effects that are within the moderate, large or very large categories.

Table 14-3 Significance of Potential Effects

		Magnitude				
		No change	**Negligible**	**Minor**	**Moderate**	**Major**
Sensitivity	**Very High**	Neutral	Slight	Slight or Moderate	Large or Very Large	Very Large
	High	Neutral	Slight	Slight or Moderate	Moderate or Large	Large or Very Large
	Medium	Neutral	Neutral or Slight	Slight	Moderate	Moderate or Large
	Low	Neutral	Neutral or Slight	Neutral or Slight	Slight	Slight or Moderate
	Negligible	Neutral	Neutral	Neutral or Slight	Neutral or Slight	Slight

Source: DMRB LA 112, Revision 1, Table 3.12 Magnitude of impact and typical descriptions

Human Health

14.3.8 The assessment on human health focuses on those impacts that are likely to have significant effects on the community in line with IEMA guidance. As above, significance has been determined by considering the sensitivity of the receptor, as well as the magnitude of the impact on those receptors.

14.3.9 The following receptors are included in the assessment:

- Residents

- On-site workers
- Users of recreational routes
- Users of open space
- Users of community services and social infrastructure

Sensitivity

14.3.10 Table 14-4 below sets out criteria that has been used to describe and assess the sensitivity of receptors, as outlined in IEMA: Determining Significance for Human Health in Environmental Impact Assessment.[10]

Table 14-4 Sensitivity of Receptors

Sensitivity	Criteria
High	High levels of deprivation (including pockets of deprivation); reliance on resources shared (between the population and the project); existing wide inequalities between the most and least healthy; a community whose outlook is predominantly anxiety or concern; people who are prevented from undertaking daily activities; dependants; people with very poor health status; and/or people with a very low capacity to adapt.
Medium	Moderate levels of deprivation; few alternatives to shared resources; existing widening equalities between the most and least healthy; a community whose outlook is predominantly uncertainty with some concern; people who are highly limited from undertaking daily activities; people providing or requiring a lot of care; people with poor health status; and/or people with a limited capacity to adapt.
Low	Low levels of deprivation; many alternatives to shared resources; existing narrowing inequalities between the most and least healthy; a community whose outlook is predominantly ambivalence with some concern; people who are slightly limited from undertaking daily activities; people providing or requiring some care; people with fair health status; and/or people with a high capacity to adapt.
Negligible	Very low levels of deprivation; no shared resources; existing narrow inequalities between the most and least healthy; a community whose outlook is predominantly support with some concern; people who are not limited from undertaking daily activities; people who are independent (not a carer or dependent); people with good health status; and/or people with a very high capacity to adapt.

Source: IEMA (2022): Determining Significance for Human Health in Environmental Impact Assessment Baseline Conditions

[10] Institute of Environmental Management and Assessment (IEMA). (2022). 'Determining significance for Human Health in Environmental Impact Assessment'. Available at: https://www.iema.net/media/yljb2nbs/iema-eia-guide-to-determining-significance-for-human-health-nov-2022.pdf

Magnitude

14.3.11 The magnitude of impact on community and health receptors has been assessed using the criteria set out in Table 14-5 and professional judgement.

Table 14-5 Impact Magnitude Criteria

Magnitude	Criteria
Major	High exposure or scale; long-term duration; continuous frequency; severity predominantly related to mortality or changes in morbidity (physical or mental health) for very severe illness/injury outcomes; majority of population affected; permanent change; substantial service quality implications.
Moderate	Low exposure or medium scale; medium-term duration; frequent events; severity predominantly related to moderate changes in morbidity or major change in quality-of-life; large minority of population affected; gradual reversal; small service quality implications.
Minor	Very low exposure or small scale; short-term duration; occasional events; severity predominantly related to minor change in morbidity or moderate change in quality-of-life; small minority of population affected; rapid reversal; slight service quality implications.
Negligible	Negligible exposure or scale; very short-term duration; one-off frequency; severity predominantly relates to a minor change in quality-of-life; very few people affected; immediate reversal once activity complete; no service quality implication.

Source: IEMA (2022): Determining Significance for Human Health in Environmental Impact Assessment (magnitude category labels have been adapted for consistency within this EIA)

Significance

14.3.12 Table 14-6 below sets out the significance matrix for determining human health effects, where large or moderate effects are considered to be significant and slight or neutral are considered to be not significant.

Table 14-6 Human Health Significance Matrix

		Sensitivity			
		High	**Medium**	**Low**	**Negligible**
Magnitude	**Major**	Large	Large or Moderate	Moderate or Slight	Slight or Neutral
	Moderate	Large or Moderate	Moderate	Slight	Slight or Neutral

	Minor	Moderate or Slight	Slight	Slight	Neutral
	Negligible	Slight or Neutral	Slight or Neutral	Neutral	Neutral

Source: IEMA (2022): Determining Significance for Human Health in Environmental Impact Assessment (magnitude category labels have been adapted for consistency within this EIA)

14.3.13 The nature of the effect has also been defined as either:

- Beneficial - a beneficial health impact is identified
- Adverse - an adverse health impact is identified

14.3.14 The likely effect is also defined in terms of duration. Effects generated as a result of the construction phase of the Scheme are classified as 'short-term' to 'medium-term'. Effects that result from the Scheme once completed are classified as 'long-term'. The duration of the effect is also a determining factor in the magnitude of change, as noted in Table 14-5.

14.4 Baseline Conditions

Study Area

14.4.1 The Scheme is located in Queensferry, Flintshire. The A494 Dee Bridge provides east/west connection between Queensferry and Garden City, over the River Dee, providing access to the North Wales Expressway to the west, and the English border and M56 in the east.

14.4.2 The population and human health conditions are considered according to the following spatial areas, in accordance with DMRB LA 112.

- Local Impact Area (LIA): defined as a 500m buffer around the Order Limits (red line boundary) of the Scheme (Figure 14.1). This impact area is used for the analysis of potential impacts on land use and accessibility. Due to data limitations, acquiring baseline population data within 500m of the Scheme has not been possible. Therefore, a combination of two Middle Layer Super Output Areas (MSOAs)[11] (Flintshire 009 and Flintshire 011) is used as a proxy for the LIA when assessing potential human health effects.

[11] MSOAs are statistical geographies used in England and Wales, primarily for reporting small area statistics. MSOAs typically contain between 5,000 and 15,000 residents and 2,000 to 6,000 households.

- Wider Impact Area (WIA): defined as Flintshire County Council. As the Scheme is located close to the border of Cheshire West and Chester Council, access to health facilities in Cheshire located close to the Scheme are considered in the assessment.
- National: Wales

Population: Land-use and Accessibility

Private Property and Housing

14.4.3 There are four vacant residential properties located within the red line boundary (RLB) on Chester Road East (Figure 14.2).

14.4.4 The LIA is located in an urban area where the density of private property and housing is high.

14.4.5 Key urban areas, where the majority of residential properties are located, include Queensferry, to the south of the Scheme, and areas of Garden City, Shotton and Sealand, to the north of the Scheme. In addition, there are a small number of individual residential properties located throughout the LIA – a cluster of which is located off the A548 Sealand Road.

14.4.6 The closest residential properties to the Scheme (outside of the RLB) are located on Dundas Street in Queensferry, located approximately 30m to the northwest of the Scheme, and Claremont Avenue in Garden City, located approximately 50m north of the Scheme.

14.4.7 There is a traveller site located to the immediate southeast of the Scheme, on the south bank of the River Dee - adjacent to the Scheme.

Community Land and Assets[12]

14.4.8 There are several community resources located within the LIA, none of which lie within the RLB (Figure 14.3). These are:

- Schools:

[12] The community resources identified in this section are relevant to both the land and accessibility and human health elements of this assessment.

  - Sealand Primary School is located approximately 190m to the northeast of the Scheme.
  - Queensferry CP Primary School is located approximately 500m to the northwest of the Scheme.
- Healthcare facilities:
  - Mold Physiotherapy and Sports Injury Clinic – 15m west of the Scheme
  - Rowlands Pharmacy Queensferry – 190m west of the Scheme
  - Asda Opticians – 300m west of the Scheme
  - Queensferry Medical Practice – 260m west of the Scheme
  - Griffiths Pharmacy & Travel Clinic & Weight Management Clinic - 260m northwest of the Scheme
  - St John Ambulance Cymru – 300m west of the Scheme
- Activity/Leisure/Sports Centres:
  - Deeside Rhythmic Gymnastics Club is located approximately 500m to the northwest of the Scheme.
  - Dee Rink, the national ice sports centre of Wales, is located approximately 400m to the northwest of the Scheme.
  - Deeside Leisure Centre is located approximately 490m to the northwest of the Scheme.
  - Deeside Family Martial arts Taekwondo Flintshire, a Taekwondo school, is located approximately 480m to the north of the Scheme.
- Community Centres:
  - Queensbury War Memorial Institute: located approximately 200m to the north of the Scheme.
  - Sealand Youth Centre, located approximately 440m to the northeast of the Scheme
- Places of Worship:
  - St Andrews Church, an Anglican church located approximately 500m northeast of the Scheme.
  - Church of the Blessed Trinity, a catholic church located approximately 190m to the north of the Scheme.
- Playgrounds, Recreation facilities, and Green and Open Spaces:
  - Queensbury Primary School Playing fields, located approximately 450m to the northwest of the Scheme.

- Playground located on Bridge View in Garden City, located approximately 430m to the north of the Scheme.
- Garden City Skatepark, located approximately 480m to the northeast of the Scheme.
- Playing fields located on Welsh Road, located approximately 420m to the northeast of the Scheme.

Development Land and Business

14.4.9 There are no development sites within the RLB. However, based on the Flintshire Local Development Plan, there is one development site located in the LIA. The Northern Gateway Site, which is north of the B5441 in Garden City. The site is currently under construction and, once operational, will be an employment-led mixed use development with associated infrastructure comprising accesses, roads, footpaths, cycle paths, earthworks, and flood mitigation.

14.4.10 There are two operational businesses within the RLB – namely, T K Motor Repairs (on Chester Road East) and J. & M. Garner (Haulage) Limited located on By-Pass Road. A further two business properties are located in the RLB, however these are currently vacant.

14.4.11 A total of 81 businesses are located within the LIA (Figure 14.4). This includes supermarkets, shops, restaurants, cafes & catering businesses, and services and supplier businesses, reflecting the LIA's location across two neighbouring rural residential towns.

14.4.12 The main high street of Queensferry is located on Station Road, containing a number of businesses such as convenience shops, restaurants, cafes, hair salons, barbershops and tanning salons.

14.4.13 The LIA is also home to manufacturing and industrial businesses to the east and west of the A494, including but not limited to those within the Interlinq Trade Park and Expressway Business Park.

Agricultural Land Holdings

14.4.14 One agricultural land holding, to the north of the River Dee, lies within the RLB. There are several agricultural land holdings within the LIA, to the northeast and southeast of the Scheme location, comprised of predominantly large fields separated by hedgerows and local roads. The majority of the land within the LIA is used for arable production. Access to these areas of land is by a combination of local roads. The field nearest to the A494 is approximately 42ha and is currently cultivated for arable and vegetable cropping.

Walkers, Cyclists and Horse-riders

14.4.15 According to the Flintshire County Council's Public Rights of Way (PRoW) data, there are several PRoW within the LIA (Figure 14.5). These are:

- Hawarden 29 Footpath: Stems from the A550 southwards towards Bennett's Lane.
- Hawarden 32 Footpath: Stems from Pentre southwards to Colliery Lane
- West Saltney 15 Footpath: Stems from the West Saltney 3 Footpath westwards towards the A494
- West Saltney 3 Footpath: Stems from Factory Road and travels north and then east along the south bank of the River Dee
- West Saltney 6 Footpath: Stems from Chemistry Lane northward and then westward towards the West Saltney 14 Footpath
- West Saltney Footpath 14: Stems from the A494 eastward towards West Saltney 6 Footpath
- West Saltney 7#1 Footpath: Stems from the West Saltney 3 Footpath Westward along the bank of the River Dee towards West Saltney 7#2 Footpath
- West Saltney 7#2 Footpath: Stems from West Saltney 7#1 Footpath westward towards the B5441
- West Saltney 7 Footpath: Stems from the A494 northwards towards West Saltney 7#2 Footpath
- West Saltney 16 Footpath: Stems from the B5441 westward along the south bank of the River Dee

- West Saltney 8 Footpath: Stems from the B5441 westward towards Corus Shotton Sports & Social Club
- West Saltney 10 Footpath: Stems from West Saltney 8 Footpath south-westward towards Chester Road West
- Hawarden 146 Footpath: Runs along the length of Aston Road, stemming from the beginning of Aston Road to Dee View
- Sealand 4 Footpath: Stems from Welsh Road eastward towards the Sealand 7 Bridleway
- Sealand 16 Footpath: Stems from Sealand Road southward towards Sealand 10 Footpath
- Sealand 10 Footpath: Stems from Sealand 8 footpath running eastwards towards Ferry Lane.
- Sealand 2 Footpath: Stems from Sealand 1 Footpath running eastwards along the north bank of the River Dee
- Sealand 1 Footpath: Stems from Sealand 2 Footpath running westwards along the north bank of the River Dee

14.4.16 Information on the level and frequency of use as well as the type of user (e.g., whether vulnerable travellers use any of these routes) of the WCH routes is not known.

Human Health

14.4.17 Due to data limitations, establishing a baseline of the population within 500m of the Scheme has not been possible. To establish the baseline, a combination of two MSOAs has been used as a proxy – namely Flintshire 009 and Flintshire 011.

Population and Age Structure

14.4.18 The table below shows the population and age structure of the LIA, Flintshire and Wales.

Table 14-7 Population and Age Structure

Area	Total population	Children (under 16)	Young people (16-24)	Working age population (16-64)	Older people (65+)

LIA (proxy)	15,169	18.5%	8.2%	63.3%	18.2%
Flintshire	155,812	17.4%	8.9%	60.7%	21.9%
Wales	3,105,600	17.3%	10.6%	61.1%	21.6%

Source: Population Estimates, ONS (2023)

Employment and Economic Activity

14.4.19 The table below shows the economic activity rate, employment rate and unemployment rate for the working age population (16-64) within the LIA, Flintshire and Wales.

Table 14-8 Employment and Economic Activity

Area	Working age population (16-64)	Working age population (16-64) (% of population)	Economic activity rate (% of working age population)	Employment rate (% of working age population)	Unemployment rate (% working age population)
LIA (proxy)	9,601	0.5%	81.3%	78.8%	3.0%
Flintshire	94,619	60.7%	81.2%	79.1%	2.6%
Wales	1,933,653	61.1%	76.2%	73.0%	3.3%

Source: Census 2021, ONS (2025) & Annual Population survey, ONS (2024)

- The economic activity rate in the LIA (81.3%) is in line with figures for Flintshire (81.2%) but is considerably **higher** than the figure for Wales (76.2%).
- The employment rate in the LIA (78.8%) in in line with that of Flintshire (79.1%) but is considerably **higher** than the figure for Wales (73.0%).

Employment by Industry

14.4.20 As the Scheme will likely affect employment at the district level, the table below shows employment figures by industry in Flintshire and Wales.

Table 14-9 Employment by Industry

Industry	Flintshire	Wales
Agriculture, forestry & fishing (A)	0.6%	1.2%
Mining, quarrying & utilities (B,D and E)	1.4%	1.7%
Manufacturing (C)	26.4%	10.7%
Construction (F)	4.9%	4.8%
Motor trades (Part G)	1.7%	1.9%

Wholesale (Part G)	3.1%	2.3%
Retail (Part G)	6.9%	8.9%
Transport & storage (inc postal) (H)	5.6%	4.2%
Accommodation & food services (I)	6.2%	8.7%
Information & communication (J)	1.4%	2.3%
Financial & insurance (K)	0.8%	3.0%
Property (L)	0.7%	1.5%
Professional, scientific & technical (M)	6.9%	5.1%
Business administration & support services (N)	9.7%	6.7%
Public administration & defence (O)	5.6%	8.1%
Education (P)	6.2%	9.0%
Health (Q)	6.9%	15.2%
Arts, entertainment, recreation & other services (R,S,T and U)	3.1%	4.7%

Source: Business Register and Employment Survey, ONS (2019)

14.4.21 The largest industries of employment in the WIA of Flintshire are manufacturing (26.4%) and business administration & support services (9.7%). Retail, health and professional, scientific & technical sectors each employ 6.9% of the working population. The proportion of the working population employed in the manufacturing sector in Flintshire (26.4%) is considerably higher than the proportion in Wales (10.7%).

Deprivation

14.4.22 The table below shows households by the deprivation dimensions in the LIA, Flintshire and Wales.

Table 14-10 Deprivation

Area	Household is not deprived in any dimension	Household is deprived in one dimension	Household is deprived in two dimensions	Household is deprived in three dimensions	Household is deprived in four dimensions
LIA (proxy)	38.9%	36.9%	18.5%	5.4%	0.3%
Flintshire	48.9%	33.5%	14.2%	3.2%	0.1%
Wales	45.9%	33.4%	16.0%	4.5%	0.2%

Source: Census, ONS (2021)

14.4.23 A summary of household deprivation is set out below:

- Only 39% of households in the LIA are not deprived in any dimension. This is considerably lower than the proportion in Flintshire (48.9%) and Wales (45.9%), suggesting that the LIA experiences higher levels of deprivation when compared to the district and national average. The WIA (Flintshire) has a slightly lower levels of deprivation compared to Wales as a whole.
- 0.3% of households within the LIA are deprived in four dimensions which is broadly in line with the proportion in Flintshire (0.1%) and Wales (0.2%).

Health Indicators

14.4.24 The table below presents key health indicators within the LIA, Flintshire and Wales. Although life expectancy data for the LIA is unavailable, using health indicators for comparator regions provides an overview of the LIA's health profile in the context of regional and national averages. The health indicators pertaining to the LIA are in line with the WIA and national averages.

Table 14-11 Health Indicators

Area	General health (% with bad or very bad health)	Disabled under the Equality Act.	Life expectancy at birth (male) (years)	Life expectancy at birth (female) (years)
LIA (proxy)	7%	21%	n/a	n/a
Flintshire	6%	19%	78.7	82.5
Wales	7%	22%	78.0	82.0

Source: Life expectancy at birth 2021-2023, Public Health Wales (2025) & Census 2021, ONS (2021)

Community, Recreational and Educational Facilities, Green and Open Spaces

14.4.25 The community, recreational, and green and open space resources located in the LIA are listed in section 14.4.8.

Healthcare Facilities

14.4.26 The nearest hospital, Deeside Community Hospital, is located 1.2km southwest of the Scheme, which is outside of the LIA. Healthcare facilities within the LIA are listed in section 14.4.8 above.

Transport Network

14.4.27 Apart from the A494, there are two major roads in the LIA:

- The B5441 provides connectivity between Queensferry and Garden City, located to the west of the LIA, via a bridge over the River Dee parallel to A494.
- The B5129 provides connectivity between Pentre and Shotton, located to the southeast and northwest of the LIA respectively.

14.4.28 There are five bus routes in the LIA, which service the bus stops along the B5441 from Queensferry to Garden City, approximately 170m parallel to the Scheme. These routes are:

- Route 10
- Route 10A
- Route 101A
- Route F1; and
- Route F5.

14.4.29 Shotton train station is located further north from the LIA on the B5129 road.

Air Quality

14.4.30 Chapter 11: Air Quality states that there are no Air Quality Management Areas (AQMAs) located in the WIA, or which are likely to be impacted by the Scheme.

Noise

14.4.31 Chapter 12: Noise and Vibration states that there are several noise and vibration-sensitive receptors close to the alignment of the Scheme, and the affected route. These include Sealand Primary School and some residential dwellings including a gypsy traveller site.

Source of Pathways of Potential Pollution

14.4.32 Chapter 6: Soils and Geology states that there are no geological conservation sites located within the vicinity of the WIA.

Landscape Amenity

14.4.33 Chapter 9: Landscape and Visual states that sensitive visual receptors include people in residential properties with direct and uninterrupted views of the Scheme, as well as any pedestrians and passive recreational users of paths and open spaces near to the Scheme. As mentioned previously, the LIA is an urban area where the density of private property and housing is high.

14.5 Potential Impacts

14.5.1 The following potential impacts from the Scheme have been identified for both construction and operation stages.

Construction Impacts

Land Use and Accessibility

14.5.2 Construction of the Scheme will require land from residential and commercial buildings in the LIA, leading to the demolition and permanent loss of these properties. Agricultural land within the LIA will also be permanently required - potentially impacting on the function and viability of impacted agricultural holdings.

14.5.3 Road closures are not anticipated during the construction period. However, construction of the Scheme will require changes in road layouts throughout the construction period. Changes to access, as well as increases in traffic from construction activities, may affect access to a number of receptors within the LIA particularly in terms of increased journey time and associated community severance.

14.5.4 Temporary diversions or closures of WCH routes (including PRoW, footways, road crossings and long-distance routes) will be needed within the LIA. This will result in changes to accessibility and increases to journey lengths for users.

Human Health

14.5.5 Construction of the Scheme would result in a range of activities which will adversely alter the amenity of the local community. Influencing factors include an increase in HGV and other construction traffic on local roads, the establishment of construction sites, the installation and use of construction equipment, as well as the presence of construction workers in the LIA.

14.5.6 Receptors located in proximity to temporary work areas are likely to experience changes in amenity during the construction period. For an amenity effect to be identified, at least two residual effects (specifically noise, vibration, air quality and/or visual effects) must combine at the same location/receptor at the same time.

14.5.7 Temporary increases in traffic from construction activities could impact access to number of health facilities, transport services, community, recreational and educational facilities and green and open spaces within the WIA.

14.5.8 Changes to the local road network during the Scheme construction will lead to temporary changes in access to a number of healthcare facilities, transport services, community, recreational and educational facilities, and green and open spaces to in the LIA and WIA.

14.5.9 Construction of the proposed Scheme may impact on social capital. The introduction of a temporary construction workforce into established communities has the potential to adversely alter people's perceptions of, and interactions with their communities – modifying behaviour and the value they place on social capital. The connections between individuals within communities, and the increased likelihood that arises through these networks for individuals to feel valued, to feel a sense of belonging, to have companionship and to support each other, is important for health and wellbeing. Adverse effects on health from changes in social capital could be experienced as a reduction in wellbeing or as physiological effects on the body's hormonal and immune systems, with increased susceptibility to mental and physical illness.

14.5.10 Construction of the proposed Scheme will impact upon employment and income across the WIA. There is a strong correlation between employment status and health and wellbeing outcomes. Being employed increases a household's income, which can improve physical and psychological wellbeing, providing people with the financial means to access the goods and services which they need. There is also evidence to suggest that employment status may also be a consequence of physical and mental health, rather than the direct cause.

Operational Impacts

Land Use and Accessibility

14.5.11 Highway enhancements, including improved junctions, will improve journey time and reliability for traffic along the A494 and merging roads, reducing severance to local services for all users. The works are likely to result in a reduction in congestion on the A494 in Queensferry and Garden City. This will permanently improve access to residential properties, community receptors, businesses and agricultural land holdings within the LIA.

14.5.12 The operation of the Scheme will improve access and decrease severance to green space, recreation, and physical activity in the LIA due to improvements to flow of traffic along the A494 and merging roads. The Scheme will also permanently reduce severance for those wishing to use WCH routes within the LIA to access community receptors. This will reduce feelings of isolation and encourage the use of WCH routes, resulting in positive impacts on physical and mental health.

Human Health

14.5.13 The Scheme will improve the provision of infrastructure that encourages active travel modes, supports a potential reduction in pollutants and access to employment with the potential for positive health impacts.

14.5.14 The works will result in a reduction in congestion on the A494 in Queensferry and Garden City. This will permanently improve access to health receptors within the LIA and WIA.

14.5.15 The operation of the Scheme will reduce congestion and reduce journey time, improving the access to employment for people living within the LIA and WIA and supporting the future economic growth of the region.

14.6 Mitigation Measures Forming Part of the Scheme Design

14.6.1 The proposed Scheme has been designed to minimise land take from residential properties, community resources and businesses.

14.6.2 A Construction Traffic Management Plan (CTMP) will be implemented during the construction phase of the proposed Scheme. This will make sure that access is maintained, and disruption is minimised as far as possible to residential properties, community receptors, agricultural land, businesses and development land, and areas of open space and recreation.

14.6.3 A Construction Environmental Management Plan (CEMP) will adopt mitigation measures to control construction dust, noise and visual effects that may impact the human health of the local population. Chapter 9 Landscape and Visual Effects, Chapter 11 Air Quality and Chapter 12 Noise and Vibration provide further detail around respective mitigation measures.

14.6.4 Provision of appropriate signage for temporary WCH diversions, including wayfinding and duration of works.

14.6.5 The area of agricultural land required for construction of the Scheme will be minimised. Land that is not ‘best and most versatile’ (BMV) land will be preferentially used.

14.6.6 Compensation schemes for the loss of agricultural land will be considered.

14.6.7 Engagement will be undertake with local people and businesses setting out how construction activities may impact them, for example through WCH closures and associated diversions.

14.7 Assessment of Construction Effects

Construction Impacts on Land Use and Accessibility

Land Take Effects

14.7.1 Construction of the Scheme requires land take from residential properties, businesses and agricultural land holdings within the LIA. Land take effects during construction are detailed in the **Table 14-12** below.

Table 14-12 Land Take Effects During Construction

Receptor	Sub-receptor	Sensitivity	Description of impact	Magnitude of impact	Significance of effect
Private property and housing	1-4 Bridge Houses, Chester Road East, Queensferry, CH5 1TD	Low – these properties are uninhabited and are long-term vacant properties. The land required does not fall within land allocated for housing.	The realignment of the A494 and the construction of a new shared use cycle path and maintenance access area will require the demolition of these four residential properties on Chester Road East.	Negligible – the loss of four residential properties results in a very minor loss to the overall housing stock in the LIA. Additionally, the properties have been uninhabited for several years, therefore would not result in the displacement of residents.	Neutral
Community resources	No community resources are affected by land take.				
Development land and businesses	Flintshire County Depot	Low – the warehouses are vacant. The land required does not fall	Land required for the A494 realignment, including the construction of a new	Negligible – businesses previously occupying these warehouses have already been relocated. The	Neutral

		within land allocated for employment.	maintenance access road and shared use cycle path, will result in the demolition of two warehouses linked to the Flintshire County Depot.	loss of the buildings therefore does not result in changes to operating conditions or affect the viability of businesses.	
	J&M Garner Haulage	Medium - this is an existing employment site of less than one hectare in size.	Land required for the reconstruction of a shared user cycle track will require land from this business	Major – land required will result in the permanent loss of this business.	**Moderate adverse (significant)**
	T K Motor Repairs	Medium - this is an existing employment site of less than one hectare in size.	Land required for the construction of a new maintenance access road and shared use cycle path, will result in the demolition of buildings being used by T K Motor Repairs.	Major – land required will result in the loss of this business.	**Moderate adverse (significant)**
	Garages, Chester Road East	Low – the garages are vacant. The land required does not fall within land allocated for employment.	Construction of a new maintenance access road and shared use cycle path will result in the demolition of garages used by a former auto repair business.	Negligible – the garages are no longer in user. The loss of the buildings therefore does not result in changes to operating conditions or affect the viability of businesses.	Neutral
Agricultural land holdings	Sealand Manor Farm	High - this land is agricultural infrastructure (arable land) on which the farm enterprise is dependent.	Land required for the construction of a new shared-use cycle path and a temporary construction compound will permanently	Minor – 4% of Sealand Manor Farm will be required permanently	Slight adverse (not significant)

			require 3.7 hectares of agricultural land from Sealand Manor Farm		

Temporary Changes in Access

14.7.2 Access effects during construction are detailed in **Table 14-13**.

Table 14-13 Access Effects During Construction

Receptor	Sub-receptor	Sensitivity	Description of impact	Magnitude of impact	Significance of effect
Private property and housing	Riverside Way gypsy and traveller site	High – these are residential properties which are used every day.	Construction of the proposed Scheme and realignment of Riverside Way will temporarily affect the A494/Riverside Way junction throughout the two-year construction period, leading to slight changes in access throughout this period.	Negligible – construction activities will be undertaken in a way that allows access to be maintained throughout the construction period. Any delays will be minimal.	Slight adverse (not significant)
Development land and businesses	Chaloner Auto Repairs and MOT Centre	Medium - the business is an existing site of employment of less than one hectare	Construction of the proposed Scheme and realignment of Riverside Way will temporarily affect the A494/Riverside Way junction	Negligible – construction activities will be undertaken in a way that allows access to be maintained throughout	Neutral

			throughout the two-year construction period, leading to slight changes in access throughout this period.	the construction period. Any delays will be minimal	
Walkers, cyclists and horse-riders	WCH route between Belvedere Close and Chester Road East	Very high - this route connects residential properties in Deeside (west of the A494) with amenities in Queensferry. This is, therefore, likely to be used for commuting and recreation daily.	This WCH route falls within the RLB of the proposed Scheme.	No change – construction activities will have no impact on this route. The route will remain open throughout the construction period	Neutral
	Footpath – West Saltney 3	High - while this route is unlikely to be used frequently, it is one of the very few WCH routes linking the Riverside Way gypsy and traveller site to amenities to the south and east of the A494.	As part of the proposed Scheme, approximately 185m of this route will be upgraded to a shared use path. Access will be temporarily reduced during the construction period.	Negligible - the route will remain open throughout the construction period, with users being managed around the boundary of the works	Slight adverse (not significant)
	Footpath – West Saltney 6	Low - this route has fallen into disuse through past severance.	Works to upgrade the route into a shared use path will temporarily impact this route during the construction period.	Negligible - the route will remain open throughout the construction period, with users being managed around the boundary of the works	Neutral

	Footpaths - West Saltney 7#1 and West Saltney 7#2	High – West Saltney 7#1 and West Saltney 7#2 provide access between two predominantly industrial areas located on either side of the A494. However, the route further serves the Riverside Way gypsy and traveller site, providing the sole pedestrian access across the A494 for the site. There are limited alternative A494 pedestrian crossings – the nearest being a walking distance of 1.5km south of West Saltney 7#1 and 7#2.	The realignment of the A494 will require the extension, and therefore temporary closure, of this footpath for a period of two years.	Major - without reprovision in the vicinity of the footpaths West Saltney 7#1 and 7#2, users of the footpath would need to walk an additional 1.5km to the next crossing.	**Large adverse (significant)**
	Sealand 2 / Wales Coast Path (Llwybr Arfordir Cymru)	Very high – this route is national walking trail, with sections of the route being used daily for commuting and recreational purposes. It is, however, noted that the section of the route being closed is unlikely to be used for daily commuting purposes.	The Wales Coast Path runs along the River Dee via footpaths Sealand 1, Sealand 2, over Jubilee Bridge connecting to West Saltney 8. The realignment of the A494 will require the temporary closure of Sealand 2 for a period of two years. A temporary diversion	Major – the proposed diversion will increase walking distances by approximately 1.1km.However, the magnitude of effect remains major as recreational users will be affected for a period of two years.	**Very large adverse (significant)**

			will be put in place (via Welsh Road, Foxes Lane and a footpath connecting to the Wales Coast Path) for the duration of the construction period.		
	Footpath/cycleway between Claremont Avenue and the Wales Coast Path	High - the location of the footway suggests it is used daily for both commuting and recreational purposes.	Works to widen and resurface this route will temporarily affect the accessibility of this route.	Negligible - the route will remain open throughout the construction period, with users being managed around the boundary of the works	Slight adverse (not significant)

Construction Impacts on Human Health

Temporary Changes in Access to Local Services

14.7.3 No changes in access to local services have been identified during the construction of the Scheme. The existing A494 River Dee Bridge will remain fully open during the two-year construction of the bridge replacement and no other road closures are anticipated.

Temporary Changes in Social Capital

14.7.4 Temporary changes in social capital during construction are detailed in **Table 14-14**.

Table 14-14 Changes in Social Capital During Construction

Receptor	Sub-receptor	Sensitivity	Description of impact	Magnitude of impact	Significance of effect
Social capital	Social cohesion	Medium – the sensitivity of the LIA is medium as there are few alternatives to shared resources.	During the day, the workforce will be present on construction sites and compounds. Although the number of construction workers is currently unknown, the presence of construction workers is likely to be noticeable for those living in the area, particularly for people living in the villages of Garden City and Sealand Manor.	Minor - construction workers are likely to be spread out throughout the LIA. There will be a minor change in quality of life as the impact will be rapidly reversed.	Slight adverse (not significant)
	Employment and income	Low - the sensitivity of the WIA is low due to having lower than	During construction, there is likely to be a beneficial impact on the economy through both new and existing contracts entered into with local companies	Minor - a relatively small minority of the population is	Slight beneficial

		national levels of deprivation (as set out in 14.4.14).[13]	across the WIA. This is likely to be beneficial for employment opportunities associated with direct employment from the construction activity, as well as for local businesses through indirect spend, during the two-year construction period.	likely to be affected for a period of two years.	(not significant)

[13] When it comes to employment and income, the WIA is used as the study area as workforce is likely to be sourced from the WIA and wider areas.

Temporary Changes in Access to Green Space, Recreation and Physical Activity

14.7.5 As set out in **Table 14-13** above, there will be changes in access for users of WCH routes in the LIA throughout the two-year construction period – altering opportunities to engage in recreation and physical activity along these routes.

14.7.6 **Table 14-15** sets out access impacts associated with the construction of the proposed Scheme which will to lead to additional changes in opportunities to engage in recreation and physical activity.

Table 14-15 Changes in Access to Green Space, Recreation and Physical activity

Receptor	Sub-receptor	Sensitivity	Description of impact	Magnitude of impact	Significance of effect
Access to green space, recreation and physical activity	River Dee	Low - the population of the LIA have comparable general health levels compared to regional and national areas.	Construction of the proposed Scheme will restrict recreational navigation activities along the River Dee at certain periods throughout the two-year construction period. The frequency and duration of river closures is currently unknown, however closures are expected to be short term. Recreational navigation activities will not be possible during this time.	Negligible – access restrictions will be very short term.	Neutral

Temporary Changes in Amenity

14.7.7 Temporary changes in amenity during construction are detailed in **Table 14-16.** As mentioned in section 14.5, changes in amenity result from a combination of significant residual (post-mitigation) effects reported in other topics - specifically noise, vibration, air quality and visual effects. For an amenity effect to be identified, at least two residual effects must combine at the same location/receptor.

Table 14-16 Changes in Amenity

Receptor	Sub-receptor	Sensitivity	Description of impact	Magnitude of impact	Significance of effect
Changes in amenity	Residential properties located on the following streets: • Claremont Avenue (riverside properties), • Queen Street, • The eastern extent of Dundas Street, and • Riverside Way (gypsy and traveller site residents).	High – these are residential properties which are used every day.	During construction, residents living in proximity to the A494 will experience a significant adverse amenity effect as a result of construction activities. Residents living on the aforementioned streets will experience a significant increase in noise as well as a significant change in visual amenity throughout the construction period.	Moderate – residents will experience a major change in quality of life for up to two years.	**Moderate adverse (significant)**

14.8 Assessment of Operational Effects

Operational Impacts on Land Use and Accessibility

14.8.1 No operational land take effects have been identified.

Permanent Changes in Access to Community Receptors

14.8.2 Changes in access for community receptors during operation are detailed in **Table 14-17**.

Table 14-17 Changes in Access for Community Receptors During Operation

Receptor	Sub-receptor	Sensitivity	Description of impact	Magnitude of impact	Significance of effect
Private property and housing	Private property and housing in the LIA	High - the sensitivity of the receptor is high as there are a large number of homes within the area, and these residential properties will be accessed daily.	There are likely to be beneficial impacts on safety and access to private property and housing as a result of the Scheme. The aims of the Scheme are to provide improved journey times and reliability in the local area and it is likely that this would improve access to private property and housing in the LIA	Negligible - there will be a very minor improvement in journey reliability	Slight beneficial (not significant)
Development land and businesses	Development land and businesses in the LIA	Very high - the sensitivity of the receptor is high, as existing land within the LIA allocated for development land and existing business exceeds 5 hectares	There are likely to be beneficial impacts on access to development land and businesses as a result of the Scheme. The aims of the Scheme are to provide improved journey time and reliability in the local area and it is likely that this would improve access to development land and businesses in the LIA during the operation period.	Negligible - there will be a very minor improvement in journey reliability	Slight beneficial (not significant)
WCH	New shared use cycle path along A494	Low – an alternative route, via the Jubilee Bridge (approximately 155m west of the A494), currently provides	A new shared use cycle track will be created along the length of the proposed Scheme. The new cycle	Minor – the proposed Scheme results in the provision of a new	Slight beneficial

		walkers and cyclists with direct access between the settlements of Garden City and Queensferry. The route via the Jubilee Bridge is, therefore, likely to remain the preferred commuter route for active travellers. As such the sensitivity of the receptor is assessed as low. However, it is noted that there are no WCH routes that run along the full length of the A494. Those that do exist do not offer a meaningful route for any users.	track will run from Chester Road East, over the proposed bridge deck, connecting to the existing WCH route to north of the River Dee terminating at Foxes Lane. The new cycle path will additionally provide direct access between the A494 and the wider WCH network – in particular to the Wales Coast Path (to the north of the river) and West Saltney 7#1 and 7#2.	WCH route, leading to a minor reduction in severance between the wider WCH network.	(not significant)
	Sealand 2 / Wales Coast Path (Llwybr Arfordir Cymru)	Very high – this route forms part of a national walking trail, with sections of the route being used daily for commuting and recreational purposes	As part of the proposed Scheme, a new shared use cycle route will be created, providing a direct link between the proposed A494 cycle path and footpath Sealand 2 (which forms part of the Wales Coast Path). Enhancements will additionally be made WCH routes which link to the Wales Coast Path - namely a WCH route between the Wales Coast Path and Claremont Avenue.	Minor – users of the Sealand 2 footpath wishing to cross the River Dee will no longer have to use Jubilee Bridge, resulting in an approximate 250m reduction in journey length.	**Moderate beneficial (significant)**

	Footpaths West Saltney 7#1 and 7#2	High – West Saltney 7#1 and West Saltney 7#2 provide access between two predominantly industrial areas located on either side of the A494. However, the route further serves the Riverside Way gypsy and traveller site, providing the sole pedestrian access across the A494 for the site. There are limited alternative A494 pedestrian crossings – the nearest being a walking distance of 1.5km south of West Saltney 7#1 and 7#2	The proposed Scheme includes enhancing the existing footpaths into wider, shared use cycle tracks. A new WCH link will be created, linking the existing West Saltney 7#1 to the proposed cycle path along the A494.	Minor – for users of West Saltney 7#1 wishing to cross the River Dee, the new link to the A494 will result in an approximate 50m reduction in journey length.	Slight beneficial (not significant)
	Footpath – West Saltney 6	Low - this route has fallen into disuse through past severance	This route will be upgraded into a shared use path as part of the proposed Scheme, reinstating a disused WCH route and providing an additional link between the A494 (and adjacent gypsy and traveller site) and the industrial area to the east of the proposed Scheme.	Major - the proposed Scheme results in the complete removal of severance.	Slight beneficial (not significant)

Operational Impacts on Human Health

Permanent Changes in Access to Local Services

14.8.3 Permanent changes in access to local services during operation are detailed in **Table 14-18.**

Table 14-18 Changes in Access to Local Services During Operation

Receptor	Sub-receptor	Sensitivity	Description of impact	Magnitude of impact	Significance of effect
Access to services, health and social care	Local services, health and social care	Low - the general health of the LIA population is in line with WIA and national levels.	There are likely to be beneficial impacts on access to services, health, and social care as a result of the proposed Scheme due to improved flow of traffic and therefore journey times and reliability.	Minor – journey time improvements will be minor and improvements to access will likely impact a small minority of the population.	Slight beneficial (not significant)

Permanent Change in the Provision of Green Space, Recreation and Physical Activity

14.8.4 Permanent changes in the provision of green space, recreation and physical activity during operation are detailed in **Table 14-19**.

Table 14-19 Permanent Changes in the Provision of Green Space, Recreation and Physical Activity

Receptor	Sub-receptor	Sensitivity	Description of impact	Magnitude of impact	Significance of effect
Green space, recreation and physical activity	New shared use cycle path along A494	Low - the general health of the LIA population is in line with WIA and national levels.	A new shared use cycle track will be created along the length of the proposed Scheme. It will span from Chester Road East, over the proposed bridge deck, connecting to the existing WCH route to north of the River Dee terminating at Foxes Lane. The new cycle path will additionally provide direct access between the A494 and the wider WCH network – in particular to the Wales Coast Path (to the north of the river) and West Saltney 7#1 and 7#2 (to the south of the river_. This will provide a new, segregated and safe active travel route, encouraging people to walk run and cycle which may improve the health of users.	Minor – the route will affect a small proportion of the population	Slight beneficial (not significant)
	Sealand 2 / Wales Coast Path (Llwybr Arfordir Cymru)	Low - the general health of the LIA population is in line with WIA and national levels..	As part of the proposed Scheme, a new shared use cycle route will be created, providing a direct link between the proposed A494 cycle path and footpath Sealand 2 (which forms part of the Wales Coast Path). Enhancements will additionally be made WCH routes which link to the Wales Coast Path - namely a WCH route between the Wales Coast Path and Claremont Avenue. This will provide a safe active travel route, encouraging people to walk, run and cycle which may improve the health of users.	Minor – the route will affect a small proportion of the population	Slight beneficial (not significant)

	West Saltney 7#1 and 7#2	Low - the general health of the LIA population is in line with WIA and national levels.	The proposed Scheme includes enhancing the existing footpaths into wider, shared use cycle tracks. A new WCH link will be created, linking the existing West Saltney 7#1 to the proposed cycle path along the A494. This will provide a safe active travel route, encouraging people to walk, run and cycle which may improve the health of users.	Negligible - the route is likely to be used on a one-off basis and by a very small proportion of the population.	Neutral
	Footpath – West Saltney 6	Low - the general health of the LIA population is in line with WIA and national levels..	This route will be upgraded into a shared use path as part of the proposed Scheme, reinstating a disused WCH route. This will provide a safe active travel route, supporting people to walk, run or cycle, which may improve the health of users.	Negligible - the route is likely to be used on a one-off basis and by a very small proportion of the population.	Neutral

14.9 Additional Mitigation and Monitoring

14.9.1 No further additional mitigation and monitoring required

14.10 Assessment of Cumulative Effects

14.10.1 Population and Human Health has been scoped out of the assessment of cumulative effects (as set out in Chapter 18 (Cumulative Effects)).

Inter-relationships

14.10.2 No inter-relationships effects have been identified for the population and human health chapter as this is inherently accounted for within the assessment of amenity effects – and therefore forms part of the main assessment.

Intra-relationships

14.10.3 No intra-relationships effects have been identified for the population and human health chapter.

14.11 Summary of Residual Effects

Table 14-20 Summary of residual significant effects

Receptor	Sub- receptor	Description	Overall effect
Construction – Land use and accessibility			
Development land and businesses	J&M Garner Haulage	Land required for the realignment of the A494, a shared user cycle track and maintenance access track will require land from this business, resulting in the permanent loss of this business.	Moderate adverse (significant)
Development land and businesses	T K Motor Repairs	Land required for the construction of a new maintenance access road and shared use cycle path, will result in the demolition of buildings being used by T K Motor Repairs.	Moderate adverse (significant)

Walkers, cyclists and horse-riders	Footpaths - West Saltney 7#1 and West Saltney 7#2	The realignment of the A494 will require the extension, and therefore temporary closure, of this footpath for a period of two years.	Large adverse (significant)
Walkers, cyclists and horse-riders	Sealand 2 / Wales Coast Path (Llwybr Arfordir Cymru)	The Wales Coast Path runs along the River Dee via footpaths Sealand 1, Sealand 2, over Jubilee Bridge connecting to West Saltney 8. The realignment of the A494 will require the temporary closure of Sealand 2 for a period of two years. A temporary diversion will be put in place (via Welsh Road, Foxes Lane and a footpath connecting to the Wales Coast Path) for the duration of the construction period.	Very large adverse (significant)
Construction - Human health			
Human health	Riverside residential properties on Claremont Avenue	Construction of the Scheme will result in temporary adverse amenity effects as a result of the construction of the Scheme.	Moderate adverse (significant)
Human health	Residential properties on Dundas Street	Construction of the Scheme will result in temporary adverse amenity effects as a result of the construction of the Scheme.	Moderate adverse (significant)
Human health	Residential properties on Queen Street	Construction of the Scheme will result in temporary adverse amenity effects as a result of the construction of the Scheme.	Moderate adverse (significant)
Human health	Residential properties on Riverside Way	Construction of the Scheme will result in temporary adverse amenity effects as a result of the construction of the Scheme.	Moderate adverse (significant)
Operation – Land use and accessibility			
Walkers, cyclists and horse-riders	Sealand 2 / Wales Coast Path (Llwybr Arfordir Cymru)	As part of the proposed Scheme, a new shared use cycle route will be created, providing a direct link between the proposed A494 cycle path and footpath Sealand 2 (which forms part of the Wales Coast Path). Enhancements will additionally be made WCH routes which link to the Wales Coast Path -	Moderate beneficial (significant)

		namely a WCH route between the Wales Coast Path and Claremont Avenue.	

Operation – Human health
No significant human health effects have been identified during the operational phase.

Llywodraeth Cymru / Welsh Government

A494 RIVER DEE BRIDGE REPLACEMENT SCHEME

Environmental Statement

Volume 1: Technical Assessment Report

Chapter 15: Climate Change & Greenhouse Gases

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15. Climate Change & Greenhouse Gases

15.1 Introduction

15.1.1 This Environmental Statement (ES) has been prepared on behalf of the Welsh Government by Mott MacDonald Ltd in accordance with the Highways Act 1980 (as amended) and the Environmental Impact Assessment (EIA) Regulations 2017 (EIA Regulations 2017). The project is the A494 River Dee Bridge Replacement Scheme (hereafter referred to as "the Scheme"). For an overview of the Scheme refer to Chapter 2 (The Project).

15.1.2 The EIA process is required to identify, predict and evaluate any impacts on the environment associated with the Scheme, allowing the design development and consenting requirements of the proposals to be undertaken in the full knowledge of any significant effects. The findings of the EIA process are recorded within this ES.

15.1.3 The 2017 amendments to the EIA Directive place an emphasis on climate change within the EIA process. The two main elements of this topic relevant to the Scheme are the effects on climate (i.e. the generation of greenhouse gases (GHG)[1]) during Scheme construction and operation, and the vulnerability of the Scheme to climate change. The vulnerability of the Scheme to climate change with regards to extreme rainfall events and sea levels over the lifetime of the Scheme are also considered in the processes for flood modelling and assessment, reported in Chapter 7 (Road Drainage and Water Environment).

15.1.4 Potential impacts of GHGs are discussed considering relevant policy and legislation and in the context of current GHG emissions budgets. Additionally, both the UK and Welsh Governments declared climate emergencies in 2019 placing a greater focus on reducing GHG emissions.

[1] A greenhouse gas is a gas that absorbs and emits radiant energy within the thermal infrared range. Greenhouse gases cause the greenhouse effect. The primary greenhouse gases in the Earth's atmosphere are water vapour, carbon dioxide, methane, nitrous oxide and ozone.

15.1.5 Assessing the vulnerability of the Scheme to climate change is fundamentally different to the remainder of the EIA assessment and topic chapters, as it assesses the impact of climate change on the Scheme receptors, as opposed to the impact of the Scheme on the environment. The assessment has been undertaken considering relevant policy, legislation and guidance, including the Welsh Government's Climate Adaptation Strategy for Wales (2024), outlining its commitments to enhancing infrastructure standards to improve resilience against climate impacts[2].

15.1.6 The scope of the GHG (or carbon[3]) assessment includes the following:

a) Impact of capital GHG emissions[4] from the construction of the Scheme;

b) Change in operational GHG emissions;

c) End-of-life impacts from the Scheme; and

d) Vulnerability of the Scheme to climate change during the construction and operational phases.

15.1.7 The effects on climate aspects of this chapter have been prepared in accordance with the Design Manual for Roads and Bridges (DMRB) LA 114 Climate[5] and WelTAG[6][7]. The assessment of the effects on climate has been undertaken in line with the principles of Publicly Available Standard (PAS) 2080:2023 Carbon Management in Infrastructure and Built Environment[8], hereafter referred to as PAS 2080. For the purposes of this assessment, GHG emissions are expressed as carbon dioxide equivalent (CO_2e)[9].

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[2] Welsh Government (2024). *Climate Adaptation Strategy for Wales*. [online] available at: Climate Adaptation Strategy for Wales (last accessed: January 2025)
[3] The term GHG is used interchangeably with carbon in this technical chapter.
[4] Capital carbon refers to emissions associated with the construction of an asset.
[5] Standards for Highways (2021). *Design Manual for Roads and Bridges – Sustainability and Environment LA 114 (Climate).* [online] available at: https://www.standardsforhighways.co.uk/dmrb/search/d1ec82f3-834b-4d5f-89c6-d7d7d299dce0 (last accessed January 2025).
[6] As the Scheme is located in Wales, WelTAG guidance was consulted. This guidance references the use of the WelTAG methodology which is used for this assessment.
[7] Department for Transport (2015). *TAG UNIT A3: Environmental Impact Appraisal.* [online] available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/638648/TAG_unit_a3_envir_imp_app_dec_15.pdf (last accessed January 2025).
[8] BSI (2023). *PAS 2080: Carbon management in infrastructure and built environment.* [online] available at: PAS 2080:2023 Carbon Management in Infrastructure | BSI (last accessed January 2025).
[9] Carbon dioxide equivalent is a standard unit of measurement in which other greenhouse gases are converted to equivalent amounts of carbon dioxide, in other words to amounts of carbon dioxide that would give the same radiative forcing. As such, carbon is used interchangeably with GHG.

15.1.8 The assessment of the vulnerability of the Scheme to climate change has been prepared in accordance with the DMRB LA 114 Climate and the Institute of Environmental Management and Assessment (IEMA) Guide to Climate Resilience and Adaptation (2020)[10], with a bespoke assessment approach adapted based on these guidance documents and professional judgement.

Competent Expert Evidence

15.1.9 The competent expert for climate change and GHG emissions is a Chartered Environmentalist with IEMA and has seven years' experience in environmental consultancy, climate change assessment and carbon management.

15.1.10 The competent expert for aspects relating to the vulnerability of the Scheme to climate change is a Senior Climate Resilience Consultant with seven years' experience in climate resilience consultancy and EIA.

15.2 Legislation and Policy Framework

National Legislation

Climate Change Act 2008

15.2.1 The Climate Change Act 2008[11] forms part of the UK Government's plan to reduce GHG emissions, committing the Government to a reduction of at least 80% of 1990 levels by 2050. In 2019 the UK Government amended the Act to commit to net zero[12] GHG emissions by 2050, supporting the Paris Agreement which provides a framework to keep global warming well below 2°C, pursuing efforts to limit the temperature increase to 1.5°C. The Climate

[10] IEMA (2020). *IEMA EIA Guide to: Climate Change Resilience and Adaptation (2020)*. [online] available at: IEMA - IEMA EIA Guide to: Climate Change Resilience and Adaptation (2020). (last accessed: January 2025).
[11] UK Gov (2008). Climate Change ACT 2008. [online] available at: Climate Change Act 2008 (last accessed January 2025).
[12] Net zero refers to a state in which the greenhouse gases going into the atmosphere are balanced by removal out of the atmosphere.

Change Act creates a new approach to managing and responding to climate change in the UK, by:

i) Setting ambitious, legally binding emission reduction targets.

ii) Taking powers to help meet those targets.

iii) Strengthening the institutional framework.

iv) Enhancing the UK's ability to adapt to the impact of climate change.

v) Establishing clear and regular accountability to the UK Parliament and to the devolved legislatures.

15.2.2 Key provisions of the Act in respect of climate change mitigation include the requirement for the Government to set legally binding carbon budgets capping the amount of GHG emissions emitted in the UK over a 5-year period, as set out in Table 15-1

Table 15-1 UK Carbon Budgets

Carbon budget	Carbon budget level	Reduction below 1990 levels
4th carbon budget (2023-2027)	1,950 $MtCO_2e$	51% by 2025
5th carbon budget (2028-2032)	1,725 $MtCO_2e$	57% by 2030
6th carbon budget (2033-2037)	965 $MtCO_2e$	78% by 2035

*Source: Department for Energy Security and Net Zero[13]

15.2.3 The Act also establishes a framework to deliver on the requirements of adapting to climate change. As set out in the Act, the UK Government are required to assess the risks and opportunities from climate change for the UK and to adapt to them. It also established the Climate Change Committee (CCC) who advise Government on climate change risk and assesses progress towards adapting to them. The UK Government is also required to produce a UK Climate Change Risk Assessment (CCRA) every five years which assesses current and future risks to the UK from climate change, including national summaries for the devolved administrations.

[13] Department for Energy Security and Net Zero (2021). *UK Carbon Budgets*. [online] available at: Carbon Budgets - GOV.UK (last accessed January 2025).

15.2.4 Following publication of the CCRA, the Act requires the UK Government to produce a National Adaptation Programme. Climate adaptation policy is a devolved matter therefore Wales has established its own adaptation programme in the form of the Welsh Government's 'Prosperity for all: A Climate conscious Wales', published in 2019 (see further details on this below).

Environment (Wales) Act 2016

15.2.5 The Environment (Wales) Act 2016 Part 2 Climate Change[14] sets out the requirement in legislation for the Government to ensure the net Welsh emissions for the year 2050 are at least 80% lower than the 1990 baseline[15]. In addition, the Plan sets out the requirement for interim emission targets and carbon budgets for Wales with the first period running 2016 – 2020. The Welsh Government accepted the advice from the CCC to reduce emissions by at least 100% (i.e. 'net zero') by 2050[16].

15.2.6 In addition to the net zero target, the Welsh Government have set interim targets for 2030 and 2040, and a series of 5-year carbon budgets. The carbon budgets for Wales are set out as a percentage reduction from the 1990 baseline rather than a value. The confirmed longer-term targets from Prosperity for All: A Low Carbon Wales (see paragraph 17.2.18) have been included on the basis of each budget period for ease of comparison. These carbon budgets and targets have been estimated by using the reduction percentages and the baseline published by the National Atmospheric Emissions Inventory[17] extrapolated over the number of years associated with the budget or target as shown in Table 15-2

[14] Welsh Government (2016). *Environment (Wales) Act 2016*. [online] available at: Environment (Wales) Act 2016: overview | GOV.WALES (last accessed January 2025).
[15] The Welsh 1990 baseline carbon emissions are 56.4MtCO_2e
[16] Climate Change Committee (2020). *The path to Net Zero and progress on reducing emissions in Wales 2020.* [online] available at: https://www.theccc.org.uk/publication/the-path-to-net-zero-and-progress-reducing-emissions-in-wales/ (last accessed January 2025).
[17] National Atmospheric Emissions Inventory (2020). *Devolved Administration GHG Inventory 1990-2018*. [online] available at: The UK National Atmospheric Emissions Inventory (NAEI) | National Atmospheric Emissions Inventory (last accessed January 2025).

Table 15-2 Wales Carbon Budgets and Targets

Period	Reduction from baseline (%)	Estimate carbon budget for period ($MtCO_2e$)
1990 baseline	N/A	56.4 (56.4 / yr equivalent)
2021-2025 (Carbon Budget 2)	37	178 (35.5 / yr equivalent)
2026-2030 (Carbon Budget 3)	58	118 (23.7 / yr equivalent)
2030 (2030 target)	63	21 (yr emissions)
2040 (2040 target)	89	6.2 (yr emissions)
2050 (2050 target)	100	Net zero

15.2.7 The Act also aims to position Wales to be ready for future climate change with Parts 1 and 7 of relevance to climate resilience. Part 1 sets out to ensure that ecosystems are resilient to future climate change whilst Part 7 includes the establishment of the Flood and Coast Erosion Committee alongside provisions for law and other regulatory requirements around flood risk management and drainage[18].

Well-being of Future Generations (Wales) Act 2015

15.2.8 The Well-being of Future Generations (Wales) Act 2015[19] sets the goal for 'A prosperous Wales'. This goal is stated: "An innovative, productive and low carbon society which recognises the limits of the global environment and therefore uses resources efficiently and proportionately (including acting on climate change)".

15.2.9 The Act also includes as a goal for 'A resilient Wales' which is stated as: "A nation which maintains and enhances a biodiverse natural environment with healthy functioning ecosystems that support social, economic and ecological

[18] Welsh Government (2019): *Prosperity for All: A Climate Conscious Wales*. [online] available at: https://www.gov.wales/sites/default/files/publications/2019-11/prosperity-for-all-a-climate-conscious-wales_0.pdf (last accessed January 2025)
[19] Welsh Government (2015). *Wellbeing of Future Generations (Wales) Act 2015.* [online] available at: https://www.futuregenerations.wales/wp-content/uploads/2017/01/WFGAct-English.pdf (last accessed January 2025).

resilience and the capacity to adapt to change (for example climate change)". The Act requires that within the 12 months after an Assembly election; Ministers must publish a 'Future Trends Report' which should take into account the impact of climate change on Wales. The most recent report was published in 2021 which details trends and drivers to help shape Wales' policy direction.

National Policy

National Networks National Policy Statement (NNNPS)

15.2.10 Although the Scheme is not considered a Nationally Significant Infrastructure Project[20], due to the nature of the development the assessment of the Scheme should have regard to key policies of the National Networks National Policy Statement (NNNPS)[21]. This includes considering requirements relating to climate change.

15.2.11 In March 2024, the previous National Policy Statement for National Networks (NPSNN)[22] was reviewed and updated into the NNNPS. A revision was conducted to ensure that the NNNPS remains effective in guiding the development of nationally significant road, rail, and strategic freight interchange projects.

15.2.12 The updated NNNPS contains a section on GHG emissions. Paragraphs 5.26 to 5.42 set out how the impact of carbon will be assessed in order to meet the overarching 2050 net-zero emissions target which involves delivering on carbon budget 6 onwards. Mitigation measures in both the design and construction should be presented as part of the assessment.

[20] A Nationally Significant infrastructure Project is a large-scale project that is treated separately from normal local authority planning because of its size and importance to wider communities.
[21] Department for Transport (2024). *National Networks National Policy Statement (NNNPS).* [online] available at: https://www.gov.uk/government/publications/national-networks-national-policy-statement (last accessed January 2025).
[22] Department for Transport (2014). *National Policy Statement for National Networks (NPPSNN).* [online] available at: https://assets.publishing.service.gov.uk/media/6650b0c5d470e3279dd3325e/npsnn-print.pdf (last accessed January 2025).

15.2.13 Paragraphs 4.33 to 4.44 of the NNNPS also outline that mitigation is essential to 'minimise the most dangerous impacts of climate change', noting that new development should be planned to avoid increasing vulnerability to the range of impacts arisings from this. The potential impacts of climate change have been considered in the assessment, and through the design-development process in relation to the planning, location, design, build and operation of the Scheme.

15.2.14 Paragraph 4.40 is relevant to climate resilience of transport infrastructure which outlines that networks infrastructure should consider the latest UK Climate Projections applicable at the time of conducting the environmental assessment, to ensure identification and integration of mitigation or adaptation measures. The policy statement encourages the integration of adaptation measures into infrastructure planning and design.

Climate Adaptation Strategy for Wales 2024

15.2.15 The Climate Adaptation Strategy for Wales[2] outlines comprehensive actions to enhance resilience to climate change across various sectors, including infrastructure. It emphasises the importance of ensuring long-term resilience within design and planning, encouraging public and community involvement in adaptation efforts, while promoting collaboration among government agencies, local authorities and communities. As a key adaptation outcome for transport, the Strategy outlines that new infrastructure should be designed to be climate resilient and should take into account the most relevant and up-to-date climate data and scenarios. It also highlights that adaptation to a range of climate impacts should be considered, but most notably flooding. Key actions regarding flooding for road infrastructure include the use of enhanced drainage systems, incorporating flood resilience into design, and developing and implementing emergency response plans to ensure the road network can quickly recover from flooding events.

Welsh Government's Net Zero Strategic Plan

15.2.16 The Welsh Government's Net Zero Strategic Plan[23] outlines its commitment to becoming a net zero carbon organisation by 2030, aligning with the broader ambition for the Welsh public sector. Developed in response to the 2019 climate emergency declaration, the plan sets out 54 initiatives aimed at achieving a net zero public sector by 2030. These initiatives focus on reducing emissions from areas under direct control—such as buildings, travel, energy use, and materials—as well as tackling more complex supply chain emissions. Key actions include retrofitting public buildings for energy efficiency, transitioning to low-carbon heating, promoting active and sustainable travel, electrifying the government vehicle fleet, and embedding carbon reduction in procurement. The plan also emphasises behavioural change, improved carbon accounting, and leadership by example to drive broader societal transformation in response to the climate emergency. The strategy supports the Well-being of Future Generations (Wales) Act 2015 and will be reviewed in 2025 and 2030 to assess progress.

Prosperity for All: A Low Carbon Wales 2019

15.2.17 The Prosperity for All Plan[24] sets out the Welsh Governments approach to cutting emissions and increasing efficiency to maximise wider benefits for Wales. There are 100 policies set out within the Plan, in addition to details of the carbon budgets and interim targets for Wales.

Prosperity for All: A Climate Conscious Wales 2019

15.2.18 The Prosperity for All: A Climate Conscious Wales[25] recognises the risks associated with climate change and sets out the actions the Welsh

[23] Welsh Government (2022) *Welsh Government's Net Zero Strategic Plan*. [online] available at: Welsh Government's Net Zero Strategic Plan (last accessed July 2025)
[24] Welsh Government (2019). *Prosperity for All: A Low Carbon Wales 2019.* [online] available at: https://gov.wales/sites/default/files/publications/2019-06/low-carbon-delivery-plan_1.pdf (last accessed January 2025).
[25] Welsh Government (2019). *Prosperity for All: A Climate Conscious Wales*. [online] available at: https://www.gov.wales/sites/default/files/publications/2019-11/prosperity-for-all-a-climate-conscious-wales_0.pdf (last accessed January 2025).

Government plans to take to respond to those risks over the plan period of 2021-2025. The vision for climate change adaptation in Wales is identified in the Plan as: "*In 2030, Wales is a country which has the resources and is prepared, has the knowledge to understand the risk and challenges ahead and has the capacity to adapt to the impact of climate change*". There are eight key areas of action set out in the Plan spanning flood protection, water availability and drought, ecosystems and agriculture, amongst others. In addition, the Plan recognises the importance of protecting infrastructure from flooding and prioritises delivery of more green infrastructure as part of transport corridors.

15.2.19 A Progress Report was published in December 2022[26] to detail the advancements made in delivering the five-year plan, highlighting the ongoing efforts to protect communities, infrastructure and ecosystems to climate-related risks. The report calls for greater focus on maintenance and upgrades for roads rather than new road construction to mitigate climate risks. It also highlights the importance of integrating climate risk assessments into transport planning.

Future Wales – The National Plan 2040

15.2.20 The Future Wales – The National Plan 2040[27] is a framework for development in Wales across the next two decades. The Plan recognises the climate emergency and the challenges this poses and sets out to achieve decarbonisation and climate resilience as a key outcome. There is a strong correlation between the majority of the Future Wales policies and the decarbonisation and climate resilience outcome.

[26] Welsh Government (2022). *Prosperity for All: A Climate Conscious Wales: Progress Report December 2022*. [online] available at: Prosperity for All: A Climate Conscious Wales - Progress Report October 2022 (last accessed January 2025)
[27] Welsh Government (2021). *The Future Wales – The National Plan 2040*. [online] available at: https://www.gov.wales/sites/default/files/publications/2021-02/future-wales-the-national-plan-2040.pdf (last accessed January 2025)

Llwybr Newydd: The Wales Transport Strategy 2021

15.2.21 The Wales Transport Strategy[28] sets out how the Welsh Government can provide a transport system to create a more prosperous, green and equal society. The strategy outlines the need to make best use of existing transport infrastructure, adapt infrastructure to support a modal shift, and to explore future infrastructure improvements that reduce carbon emissions.

National Transport Delivery Plan 2022 to 2027

15.2.22 The National Transport Delivery Plan[29] sets out how Welsh Government will deliver against the priorities and ambitions set out in Llwybr Newydd: The Wales Transport Strategy 2021. Priority Two within the plan places an emphasis on accessible, sustainable and efficient services and infrastructure. Efforts to enhance the resilience of transport infrastructure to climate change have also been prioritised. This includes improving road drainage systems and upgrading infrastructure to withstand extreme weather events.

Electric Vehicle Charging Strategy for Wales

15.2.23 The Electric Vehicle Charging Strategy for Wales[30] outlines the Welsh Government's vision that by 2025, all users of electric cars and vans in Wales will have confidence in accessing reliable and convenient charging infrastructure. The strategy supports the transition to low-emission transport as part of Wales' broader decarbonisation goals. It sets out plans for a significant expansion of charging points, including between 30,000 and 50,000 fast chargers and 2,000 to 3,500 rapid/ultra-rapid chargers, with a £30 million investment over five years.

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[28] Welsh Government (2021). *Llwybr Newydd: the Wales transport strategy 2021.* [online] available at: https://www.gov.wales/llwybr-newydd-wales-transport-strategy-2021-html (last accessed January 2025).
[29] Welsh Government (2023). *National Transport Delivery Plan 2022-2027*. [online] available at: National Transport Delivery Plan 2022 to 2027 (last accessed January 2025).
[30] Welsh Government (2021) *Electric vehicle charging strategy for Wales.* [online] available at: Electric Vehicle Charging Strategy (last accessed July 2025)

Local Planning Policy

North and Mid Wales Trunk Road Agency

15.2.24 The North and Mid Wales Trunk Road Agency (NMWTRA), has aligned its carbon goals with the wider Wales national carbon target and budget plan, and supports the delivery of Welsh Government's 2030 Net Zero target. This includes ensuring road maintenance, operation, construction, and travel activity become net-zero within this timeframe.

Flintshire County Council

15.2.25 Flintshire County Council (FCC) adopted their Local Development Plan (LDP) 2015-2030[31] in 2023. Climate change and GHG policies within the LDP include:

15.2.26 STR4: Principles of Sustainable Development, Design and Placemaking:

"*To promote and create new sustainable places, all development will be designed to a high standard in line with the sustainable placemaking design principles and should achieve local distinctiveness, be inclusive and accessible, and mitigate and adapt to climate change*"

STR13: Natural and Built Environment, Green Networks and Infrastructure:

"*Development should identify, respect, protect, enhance and connect Flintshire's environmental assets to create a multifunctional network of natural and historic resources. Development should:*

i) Promote opportunities to enhance biodiversity and ensure resilience

ii) Support measures to minimise the consequences of climate change"

STR14: Climate Change and Environmental Protection:

[31] Flintshire County Council (2023). *Flintshire Local Development Plan 2015-2030*. [online] available at: https://www.flintshire.gov.uk/en/Resident/Planning/Development-plans--policies.aspx (last accessed January 2025).

"The Council will seek to mitigate the effects of climate change and ensure appropriate environmental protection in the County through:

i) Adopting a sustainable approach to water resource management including supply, surface water run-off and wastewater treatment

ii) Directing development away from flood risk areas, assessing the implications of development in areas at risk of flooding and ensuring that new development does not increase the risk of flooding elsewhere

iii) Encouraging energy efficient development, environmentally acceptable renewable and zero / low carbon energy generation and combined heat and power and communal / district heating networks

iv) *Designing development to be adaptable and resilient to the future effects of climate change*"

PCR4: Sustainability and Resilience of New Development:

i) "*Be designed so as to be resilient and adaptable to the effects of climate change*

ii) Incorporate planting, landscaping and design features within a Sustainable Management of Natural Resources (SMNR) approach which mitigate the effects of climate change such as increased rainfall events and high temperatures

iii) Make efficient use of resources through sustainable construction techniques and materials, including layout, siting and orientation to maximise solar gain, water conservation and waste reduction

iv) Incorporate renewable energy technologies and carbon sinks where appropriate."

15.2.27 The local authority area of Cheshire West and Chester is located 2.5km northeast of the Scheme. The Cheshire West and Chester Local Plan[32] was adopted in January 2015. Policy DM4 – Sustainable Construction states: "*use of innovative approaches to low carbon construction processes*" and STRAT 10(A) – Transport and Accessibility states "*reduce carbon emissions from the 2010 baseline*". Policy DM40 sets out a requirement that "*flood risk must be avoided or reduced*" and goes on to outline that a Flood Risk Assessment (FRA) is required where there are risks and climate change

[32] Cheshire West and Chester Local Plan (2017). *Local Plan. Part Two: Land Allocation and Detailed Policies. Publication draft*. [online] available at: http://consult.cheshirewestandchester.gov.uk/file/4805666 (last accessed January 2025).

must be considered. Within Part One (Strategic Policies)[33], Policy ENV6 and STRAT 1 outline the need to "*mitigate and adapt to the effects of climate change*".

15.3 Study Area

Effects on Climate

15.3.1 The construction study area includes construction related activities that occur within the Scheme boundary. Emissions also include those associated with some activities supporting construction which occur outside the physical Scheme limits, for example GHG emissions from construction related transport of materials. This includes:

i) Raw material supply

ii) Transport

iii) Manufacture

iv) Transport to site

v) Construction/installation processes, including preconstruction demolition, construction activities, and waste management.

vi) Road user emissions during the construction period

15.3.2 The study area to be considered for operation includes:

i) Regular maintenance, repair, and planned replacement of the Scheme aspects

ii) Operational energy from lighting within the Scheme extent

iii) Land use change impacts

15.3.3 The study area to be considered for end-of-life includes:

i) Deconstruction and demolition impacts

ii) Transport impacts

iii) Waste processing for reuse, recycling or other recovery

[33] Chester West and Chester Local Plan (2015). *Local Plan. Part One: Strategic Policies*. [online] available at: https://consult.cheshirewestandchester.gov.uk/portal/cwc_ldf/adopted_cwac_lp/lp_1_adopted?pointId=3252243#document-3252243 (last accessed January 2025).

iv) Disposal impacts

15.3.4 The study area does not consider:

i) Water use – there is no expected water usage during the operational stage of the Scheme.

ii) Retrofit/refurbishment/planned changes – there are no planned alterations or improvements of any assets in the Scheme.

iii) Release of gases from material emissions and removals (such as blowing agents from insulation); and fugitive emissions (such as accidental release of refrigerants from mechanical, electrical and plumbing equipment) – the Scheme is not expected to use any materials or equipment that will lead to these impacts.

iv) User emissions during operation: there is no expected net change during operation as the Scheme bridge will operate similarly to the baseline.

15.3.5 The study area for road user emissions within construction is defined by the traffic modelling forecasts for the Stage 3 Full Business Case (FBC) assessment of the Scheme[34]. This is based on an updated version of the North Wales Transport Model (NWTM). The study area aligns with the Traffic Reliability Area (TRA) in accordance with DMRB LA 114 requirements. See Figure 15-1 for the Scheme Area of Interest.

[34] A494 River Dee Bridge Replacement Scheme. NWTM – A494 Highway Model Traffic Forecasting Report. Doc ref: 395318-MMD-00-XX0RP-Z-0032

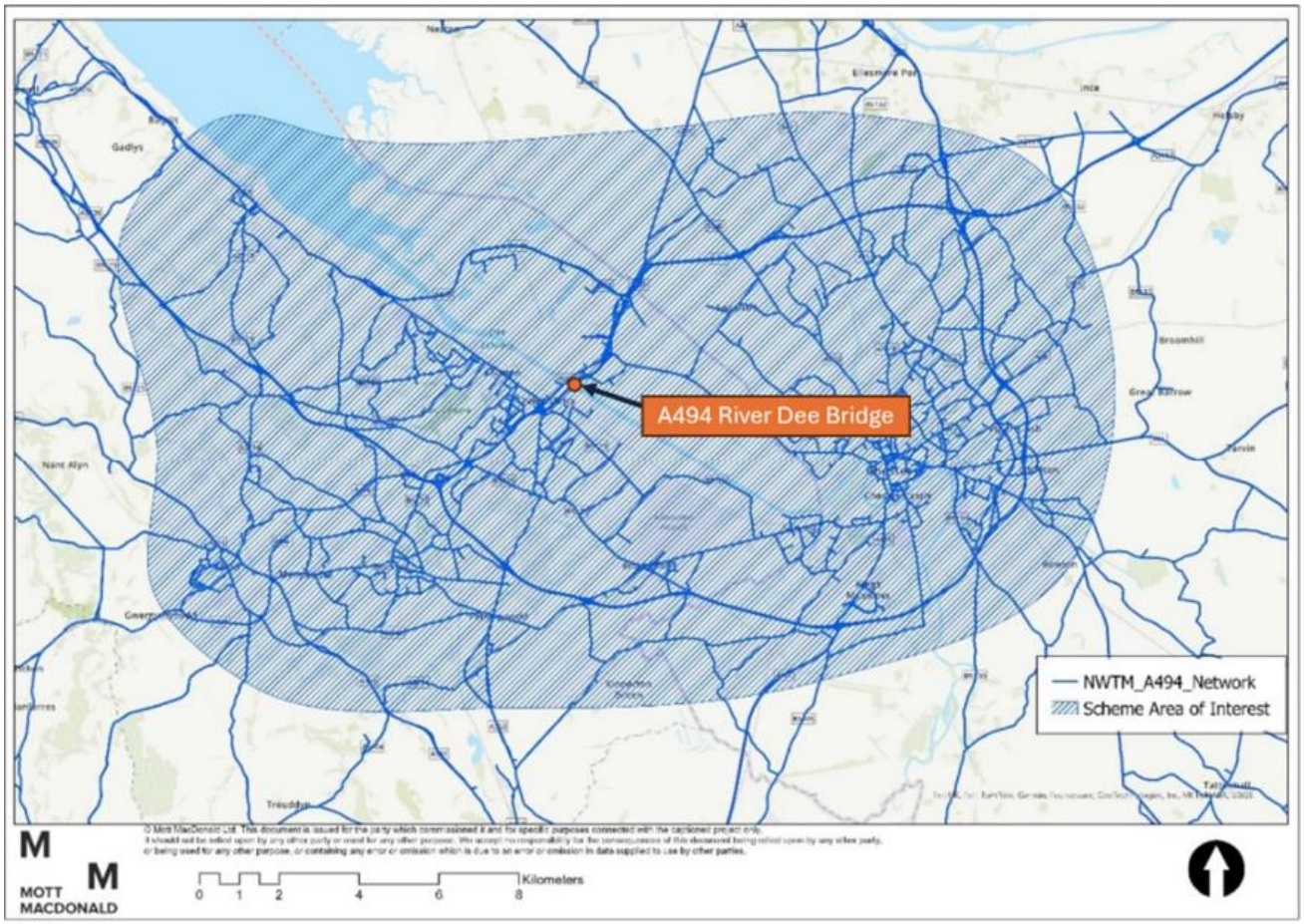


Figure 15-1 Scheme Area of Interest

15.3.6 This study area is discussed in more detail within the assessment methodology section (15.4) below.

Vulnerability of the Scheme to Climate Change

15.3.7 The vulnerability of the Scheme to climate change relates to the impacts that climate change may have on the Scheme based on projected changes in climate over the Scheme's design life and the adaptive capacity of the Scheme. Adaptive capacity refers to the ability to adjust to potential damage, take advantage of opportunities, or to respond to consequences from the impacts of climate change[35]. The study area will be based on the construction footprint and Scheme boundary (including compounds and temporary land take), as well as end-users. In accordance with DMRB LA

[35] Adapted from IPCC (2018) Annex I: Glossary [Matthews, J.B.R. (ed).] In: Global Warming of 1.5°C. Available at: www.ipcc.ch/report/sr15/glossary/ (Accessed: June 2025)

114, the construction phase has been included in the assessment scope. However, given the negligible anticipated changes in climate over the short duration of construction (2027-2029), a qualitative description of climate-related risk has been provided, as recommended by the guidance. The operation phase has been scoped in the assessment, with land projections assessed up to the 2090s (2080-2099), and marine projections up to 2100, based on the availability of future climate data.

15.4 Assessment Methodology

Effects on Climate

15.4.1 The assessment of the impact of the Scheme on climate is presented by lifecycle stage of the project. The lifecycle stages are taken from those outlined in Royal Institute of Chartered Surveyors (RICS) guidance[36], with Table 15-3 setting out those scoped into the assessment of impacts on climate and their study areas.

15.4.2 The carbon assessment is undertaken by collecting data on the Scheme's construction and operation, through obtaining a Bill of Quantities (BoQ) of the Scheme's construction materials and activities. Construction and operational activities have been converted into quantifiable units of (i.e., tCO_2e) by applying the correct emission factor utilising carbon databases and industry guidance. The calculated emissions are mapped out and categorised to reflect the Scheme's carbon footprint and identify hotspots.

15.4.3 Road user emissions were assessed based on a Do-Minimum (DM) and Do-Something scenario. The DM scenario requires an on-line bridge replacement and requires partial or full closure of this section of the A494 for a prolonged period during construction causing disruption to both the local and wider area. The impact of this temporary traffic arrangement during

[36] RICS (2024). *Whole life carbon assessment for the built environment*.* [online] available at: https://www.rics.org/content/dam/ricsglobal/documents/standards/Whole_life_carbon_assessment_PS_Sept23.pdf (last accessed January 2025).
*RICS (2024) guidance sources inputs from numerous databases to support in the calculation of their assumptions i.e., using data collected by BEIS (now DESNZ), CEN, DEFRA and UK Government.

construction is compared with a DS scenario which is the construction of the Scheme.

15.4.4 Emissions have been calculated using Welsh Transport Appraisal Guidance (WelTAG) and Defra's[37] Emission Factor Toolkit (EFT) v12.1[38].

Table 15-3 Lifecycle Stages Within Scope of Assessment and Study Area

Lifecycle stage	Study area	Emissions scope
Product stage (stages A1-A3)	Permanent construction materials within the construction site boundary and the supply chains associated with these will be included.	Primary raw material extraction, manufacturing, and transportation within the supply chain of all materials required for the permanent assets.
Transport impacts (stages A4)	Transport of permanent construction materials to site.	Emissions from vehicles transporting materials to/from site.
Construction: installation process (stages A5.1, A5.2 and A5.3)	Construction activities including pre-construction demolition; site preparation; temporary works; ground works, material waste and road user emissions during construction.	Emissions from plant and equipment, including those required for demolition activities and material waste. Road user emissions during the construction period.
In-use stage – Maintenance/ Repair/ Replacement/ Refurbishment (stages B2-B5)*	The production, transportation (to and from the site) and end of life processing of all materials required for preventative maintenance.	Emissions from maintenance processes including transport and installation activities
Operational Energy Use (stage B6)	The electricity used for scheme lighting.	Emissions from energy consumption used by the building or infrastructure asset over its lifecycle.
End-of-life stage – Deconstruction and demolition/Transport/Waste	Materials, plant and transport associated with the end-of-life stage of the Scheme.	Emissions for deconstruction and demolition activities. Emissions from transport from site to final location. Emissions

[37] Department for Environment and Rural Affairs
[38] Version 13 is the latest version as of July 2025, however at the time of the assessment v12.1 was used as this was the most up-to-date version.

Lifecycle stage	Study area	Emissions scope
processing/Disposal (stages C1-C4)*		from waste processing and disposal.
Biogenic Carbon/ Land use change	The study area's ability to store carbon. Focusing on habitat changes.	The change in the rate of stored and sequestered carbon.

**Life cycle stages B2-B5 and C1-C4 have been grouped as they have been assessed using the same or similar data and methodologies*

Construction

15.4.5 The full assessment of the construction effects on climate includes an assessment of GHGs emitted during construction, the assessment was undertaken using Excel, using credible and recognised calculation methodologies and tools. These include:

i) The National Highways Carbon Estimating Tool (NHCT) v2.6. 1[39] to supply emission factors for the embodied carbon assessment. This was used due to being publicly accessible as well as providing a wide range of emission factors and conversion rates, making future monitoring of progress more efficient.

ii) The Royal Institute of Chartered Surveyors (RICS)[40] guidance and assumptions on the transport of materials to site was used where actual supplier information is not known.

iii) Department for Energy Security and Net Zero (DESNZ) GHG reporting conversion factor framework[41] for plant and transport emission factors.

iv) Environmental Product Declarations (EPDs) detailing the emissions for certain design aspects where appropriate for bespoke items.

v) Emission Factor Toolkit (v12.1)[42] for the assessment of road users' emissions through the construction period

[39] National Highways (2022). *Carbon emissions calculation tool.* [online] available: https://nationalhighways.co.uk/suppliers/design-standards-and-specifications/carbon-emissions-calculation-tool/ (last accessed January 2025). *Whole life carbon assessment for the built environment.* [online] available: Whole_life_carbon_assessment_PS_Sept23.pdf
[40] Royal Institute of Chartered Surveyors (2023)
[41] Department for Energy Security and Net Zero (2024). *Greenhouse gas reporting: 2024*. [online] available: https://www.gov.uk/government/publications/greenhouse-gas-reporting-conversion-factors-2024 (last accessed January 2025).
[42] Department for Environment Food and Rural Affairs (2024). *Emission Factors Toolkit v12.1.* [online] available at: https://laqm.defra.gov.uk/air-quality/air-quality-assessment/emissions-factors-toolkit/ (last accessed January 2025).

vi) Mott MacDonald's in-house carbon calculation tool Moata Carbon Portal (MCP)[43] was used to supply emission factors for specific assets which were not found within the National Highways Carbon Estimating Tool.

vii) Welsh Public Sector Net Zero Carbon Reporting Guide[44] and Natural England research[45] for the land use carbon change.

15.4.6 The assessment of the impact of the Scheme on climate is presented by lifecycle stage of the project. The stages, as outlined in the RICS guidance, scoped into the assessment of impacts on climate and their study areas are presented in Table 15-3 . An overview of the calculation methods for each of the construction lifecycle stages is presented in Table 15-4 .

Table 15-4 Construction Assessment: Calculation methods used according to lifecycle Stage

Lifecycle stage	Calculation method
Product stage (stages A1-A3)	Material quantities and plant activities used for the assessment were provided by the design team in a BoQ format. The NHCT was used to map emission factors and conversion factors for the provided construction materials and assets. Where data was unavailable the Mott MacDonald Moata Carbon Portal (MCP) was used accompanied by supplementary online resourced to determine dimensions and material compositions. The calculated carbon emissions are mapped into both material type and life cycle stage to make the Scheme's carbon-intensive hotspots easier to identify.
Transport impacts (stages A4)	Benchmarks and recommended distances from the RICS guidance have been used for construction transport emission calculations[46]. Data on emission factors associated with mode of transport used was sourced from the UK Government GHG Conversion Factors database, road transport was assumed as the average laden of all rigid HGVs.
Construction: installation process (stages A5)	Quantities were provided by the design team on construction plant activities, plant type and utilisation. Exact machinery and equipment details were not provided; therefore approximations were made based on industry practice and professional judgement. These approximations are then used to identify fuel consumption rates which are then multiplied with DESNZ[37] emission factors.

[43] Mott MacDonald (2024). *Moata Carbon Portal*. [in house tool]. (Last accessed January 2025).
[44] Welsh Government (2024). *Project Carbon Sequestration*. [online] available: Welsh Public Sector Net Zero Carbon Reporting Guide (last accessed June 2025).
[45] Natural England (2021). *Carbon Storage and Sequestration by Habitat 2021 (NERR094)*. [online] available: https://publications.naturalengland.org.uk/publication/5419124441481216 (last accessed June 2025).

Lifecycle stage	Calculation method
Construction-induced Road user emissions	Due to the traffic management required to construct the Scheme, potential impacts on road user emissions have been assessed. Following the DMRB LA 114 Climate and WelTAG methodology within the Transport Analysis Guidance, the road user emissions have been calculated. This involved using the variables within the data book to calculate the emissions using an excel based tool developed in-house which produces equivalent results to the Emission Factor Toolkit. Analysis between the do minimum (DM) (without Scheme) and do something (DS) scenarios was conducted for the three-year construction period (2027-2030).

Operation

15.4.7 The full assessment of the operation effects on climate includes an assessment of GHGs emitted during the operation period, the assessment was undertaken using credible and recognised calculation methodologies and tools.

15.4.8 Operational emissions will likely extend beyond the appraisal period used for the assessment of the Scheme. Actual emissions are likely to be lower as decarbonisation will take place for plant, transport and material required for the operational period. B2-B5 stage emissions are presented as a worst-case scenario and doesn't account for future decarbonisation of the processes required for maintenance, repair, and replacement.

15.4.9 An overview of the calculation methods for each of the operation lifecycle stages is presented in Table 15-5 .

Table 15-5 Operation Assessment: calculation methods used according to lifecycle stage

Lifecycle stage	Calculation method
Maintenance/ Repair/ Replacement (stages B2-B5)*	The maintenance regime and repair processes for key components of the design has been estimated using default percentages provided by RICS guidance. Replacement impact is calculated as a multiple of A1-

Lifecycle stage	Calculation method
	5 emissions using design working lives (DWL) across the operational period.
Operational energy use (stages B6)	Operational energy use for lighting was provided by the lighting team. Total kWh usage is calculated for the whole life of the Scheme and multiplied with an emission factor from the RICS Energy Supplementary Table for electricity usage which assumes a decarbonisation scenario[47].

**Life cycle stages B2-B5 have been grouped as they have been assessed using the same methodology*

15.4.10 The operational road traffic conditions are not expected to change from the do minimum (without scheme) scenario, as such providing no difference in emissions beyond the construction period. The carriageway capacity and design speeds are identical between the DM online bridge replacement scheme and the DS offline bridge replacement scheme (Preferred Scheme). The differences in carriageway alignment between the online and offline scheme will not have an impact on modelled traffic flows and speeds. Compared against the scoping criteria in Section 3.3 of the DMRB LA 114, there will be no difference in operational AADT, HDVs, and daily average speeds of more than 20km/hr following scheme opening year.

15.4.11 Therefore, operational road user emissions have been scoped out, in line with the scoping criteria, as the Scheme does not meet these criteria through operation.

End-of-life

15.4.12 The full assessment of the end-of-life effects on climate includes an assessment of GHGs emitted at the end of the reference study period of the Scheme, the assessment was undertaken using end-of-life scenario routes provided by RICS Guidance.

15.4.13 A whole-life carbon assessment was undertaken in alignment with best practice however end-of-life emissions will likely fall outside of the scope of

[47] Emission factor based on Future Energy Scenarios 2023 Falling Short scenario.

current carbon budgets, given the long design life of the Scheme. These emissions are presented as a worst-case scenario as by the time they occur at the end of the design life (beyond 2050), both the UK and Wales are expected to have achieved net zero emissions. Therefore, the end-of-life impact would likely be mitigated through future decarbonisation measures.

Table 15-6 End-of-life Assessment: Calculation methods used according to lifecycle stage

Lifecycle stage	Calculation method
Deconstruction and demolition impacts (stages C1)	As activity data for end-of-life processes is not available, a percentage of A5 plant emissions is used as an estimate of C1 impacts.
Transport impacts (stages C2)	Transport distances are calculated as the average distance to the two closest sites for each end-of-life scenario e.g. average distance to two closest construction waste processing sites. Distances are multiplied with material mass and an emission factor. Emission factors associated with mode of transport used were sourced from the UK Government GHG Conversion Factors database, road transport was assumed as the average laden of all rigid HGVs.
Waste processing for reuse, recycling or other recovery and Disposal (stages C3 and C4)*	The mass of all materials going to waste processing or disposal is proportioned according to the RICS guidance. Material masses are multiplied with the relevant emission factor for each end-of-life route.

**Life cycle stages C3 and C4 have been grouped as they have been assessed using the same methodology*

Land use change

15.4.14 The full assessment of the land use change on climate includes an assessment of GHGs emitted during operation of the Scheme, the

assessment was undertaken using Welsh Government[48] and Natural England guidance[49].

15.4.15 The information on existing habitats has been taken from the latest ecological assessment at the site which was conducted in June 2024[50]. Previous survey data has also been considered. Each component habitat area, for both the baseline and proposed Scheme was measured in QGIS and recorded in Excel.

15.4.16 Limitations to the ecological assessment include:

a) No consideration has been given to potential habitats that may develop beyond 15 years following the Opening Year.

b) Landscape Element Codes provided are to the closest match, there is some overlap.

c) No arable land (J1.1) would be created, that which would be disturbed would be replaced.

d) There is about a 1% margin of error when comparing the baseline to the design and retained. This is attributed to the rounding up of decimals when QGIS runs the area calculations.

e) No intertidal or saltmarsh habitat would be created. This would be left to natural succession. There is the potential for off-site restoration of existing saltmarsh, which is currently in consultation with FCC and NRW.

f) Does not include the tidal River Dee as this is a dynamic habitat and none would be lost.

15.4.17 Assess habitat types were categorised as per the Joint Nature Conservation Committee Handbook for Phase 1 habitat survey[51]. These habitat types were aligned with the types provided in WG guidance and Natural England Guidance.

[48] Welsh Government (2021) *Welsh Public Sector Net Zero Carbon Reporting Guide*. [online] available: Welsh Public Sector Net Zero Carbon Reporting Guide (last accessed August 2025)
[49] Natural England (2021) *Carbon storage and sequestration by habitat: a review of the evidence (second edition)* [online] available: Carbon Storage and Sequestration by Habitat 2021 - NERR094 (last accessed August 2025)
[50] Richards Moorehead & Laing LTD (2025) *A494 RIVER DEE BRIDGE REPLACEMENT SCHEME Net Benefit for Biodiversity Statement for North and Mid Wales Trunk Road Agency.* Ref: 395318-RML-00-XX-RP-L-0001
[51] Joint Nature Conservation Committee (2010) *Handbook for Phase 1 habitat survey.*

15.4.18 Habitat types that were included in the scope of the land use assessment are presented in Table 15-7

Table 15-7 Land use habitat types

Habitat	Habitat
J5.1 Other habitat – road or track	H1.1 Intertidal mud/sand
J5.1 Cultivated/Disturbed land - arable	J1.2 Cultivated/Disturbed land – amenity grassland
B2.2 Neutral grassland – semi-improved and B6 Poor semi-improved grassland	H2.6 Saltmarsh dense/continuous
C3.1 Other tall herb and fern – ruderal	G2 Running water
J4 Bare ground	J1.4 Cultivated/Disturbed land - introduced shrub
A2.1 Scrub – dense/continuous and A2.2 Scrub - scattered	J2.1.2 Intact hedge – species poor
I2.2 Spoil	J2.1.1 Intact hedge - Native species rich
A1.1.2 Broadleaved woodland - plantation and A1.3.2 Mixed woodland plantation	J2.5 Wall
J3.6 Buildings	B6 Marsh/marshy grassland
A3.1 Broadleaved parkland/scattered trees	

15.4.19 As per RICS guidance, emissions and removals of carbon is reported in the lifecycle stage in which they occur. The effects of carbon sequestration will be compared across the entire operational period of 60 years but will not include losses of carbon storage from changes in habitat area, as data on retained habitat area was not available at the time of assessment.

Table 15-8 Land Use Change Assessment: Calculation Methods

Lifecycle stage	Calculation method
Land use change (Operation biogenic carbon)	There will be changes to land use within the construction boundary, but the effects of carbon sequestration are measured over the operational period. To assess the land use change, the habitat types and areas in the baseline scenario were compared to the Scheme scenario, in line with the biodiversity assessment. The estimated change in habitat was used in conjunction with relevant carbon flux

	factors sourced from Welsh Government and Natural England to estimate the change in carbon sequestration.

Significance of Effects

15.4.20 DMRB LA 114 has been used to determine the significance of effects on climate due to the Scheme being a highway.

15.4.21 National policy states that "It is very unlikely that the impact of a road project will, in isolation, affect the ability of Government to meet its carbon reduction plan targets".

15.4.22 As per the DMRB and LA 114 and section 15.4.21 it is considered unlikely that projects will in isolation conclude significant effects on climate.

15.4.23 DMRB LA 114 requires an assessment of the GHG emissions against UK Government budgets. The Scheme GHG emissions will be contextualised as a percentage against the UK and Welsh carbon budgets. DMRB LA 114 also states that "*projects shall only report significant effects where increases in GHG emissions will have a material impact on the ability of Government to meet its carbon reduction targets*". The Scheme uses the estimated Wales carbon budgets, whilst additionally applying the UK carbon budgets for context and comparison.

15.4.24 The significance of effects will be contextualised against the following relevant carbon budgets for which applies to the appraisal period for the Scheme, see Table 15-1 Table 15-2 :

a) Construction will take place between 2027-31 and compared against the UK 5th Carbon budget and Wales Carbon Budget 3.

b) Operation will begin from 2031 and is assessed over a 60-year appraisal period. As this is beyond the scope of the carbon budgets, effects will be contextualised against the final carbon budgets, the UK 6th Carbon budget and the Wales 2040 Target.

Vulnerability of the Scheme to Climate Change

15.4.25 The approach adopted for this assessment has drawn on the guidance identified in Section 15.1.8, good practice from other similar developments and professional judgement.

15.4.26 The assessment uses a bespoke methodology adapted from the DMRB LA 114 Climate52 and the IEMA Guide to Climate Resilience and Adaptation (2020)53. The methodology includes:

a) Identification of the present-day climate baseline using observed historical data and regional climate summaries from the UK Met Office.

b) Identification of future climate projections (future baseline) using the latest projections from the Met Office's UKCP18 User Interface.

c) Undertaking a climate change risk assessment (CCRA). This includes the:

   i) identification of potential impacts arising from climate risks during the construction and operational phases of the Scheme using the baselines, review of design information and consultation with relevant engineering designers.

   ii) Identification of climate resilience measures embedded within the Scheme design.

   iii) Assessment of risk, taking into account the likelihood and consequence of potential impacts occurring, and with consideration of embedded mitigation measures within design and operation. Identification of the significance of risks post-embedded mitigation by combining likelihood and consequence.

   iv) Identification of additional mitigation to reduce potential significant risks,.

   v) Consideration of in-combination climate impacts across other relevant EIA topics using future baseline conditions.

Data Sources

15.4.27 The following data sources have been used to inform the climate baseline:

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[52] Standards for Highways (2021). *Design Manual for Roads and Bridges – Sustainability and Environment LA 114 (Climate).* [online] available: https://www.standardsforhighways.co.uk/dmrb/search/d1ec82f3-834b-4d5f-89c6-d7d7d299dce0 (last accessed January 2025).
[53] IEMA (2022). *IEMA EIA Guide to: Assessing Greenhouse Gas Emissions and Evaluating their Significance*. [online] available: https://www.iema.net/resources/reading-room/2022/02/24/iema-guide-assessing-greenhouse-gas-emissions-and-evaluating-their-significance (last accessed January 2025).

a) State of the UK Climate 2023[54]

b) Third UK Climate Change Risk Assessment (CCRA3) – Regional Summary for Wales[55]

c) Met Office Regional Summary for Wales[56]

d) Data from the National Tide and Sea Level Facility[57]

e) Met Office UKCP18 User Interface (UI)

f) Met Office Climate Station data (Hawarden, Flintshire)[58]

Scheme Elements

15.4.28 The vulnerability of the Scheme to climate change during construction has been scoped into of the assessment in line with DMRB LA 114, however as there are likely to be negligible changes in climate within the timescales of construction, this is provided as a qualitative description of risks and disruption. The construction phase of the Scheme is currently programmed for three years from 2027 to 2029 during which climate is not anticipated to have notably changed from the present day. Receptors in the operational phase are considered for a full assessment of significance. Weather resilience measures will be incorporated into the Outline Construction Environmental Management Plan (CEMP).

15.4.29 The receptors considered within the assessment of the Scheme during the operational phase have been identified through a review of design documentation, the Scheme description of the proposed works presented in Chapter 2 and consultation with relevant engineering designers. The

[54] Collins, W., Aguilar, E. (2024). *Sate of the UK Climate 2023. International Journal of Climatology. 44. (S1) 1-177.* [online] available: (PDF) State of the UK Climate 2023 (last accessed January 2025).
[55] Committee on Climate Change (2021). *CCRA3 – Regional Summary for Wales*. [online] available at: https://www.ukclimaterisk.org/wp-content/uploads/2021/06/CCRA-Evidence-Report-Wales-Summary-Final.pdf (last accessed January 2025).
[56] Met Office (2016). *Wales: climate.* [online] available at: https://www.metoffice.gov.uk/binaries/content/assets/metofficegovuk/pdf/weather/learn-about/uk-past-events/regional-climates/wales_-climate---met-office.pdf (last accessed January 2025).
[57] National Tidal and Sea Level Facility (NTSLF). *(n.d.) Cromer tide gauge site*. [online] available at: Cromer tide gauge site | National Tidal and Sea Level Facility (ntslf.org) (last accessed January 2025).
[58] Met Office I(n.d.) Location-specific long-term averages. Available at: www.metoffice.gov.uk/research/climate/maps-and-data/location-specific-long-term-averages/gcmys04qu (Accessed: June 2025)

Scheme receptors considered within the assessment are presented in Table 15-9

Table 15-9 Scheme Receptors

Receptors	Description (to be constructed or modified)
Bridges	• New off-line single structure bridge crossing of the River Dee for westbound traffic with shared-use path for cyclists and pedestrians
Drainage	• Existing culvert extension, and new culvert • Drainage pipes • Ditches • Attenuation ponds • Relocation of pumping station and associated electricity substation
Earthworks	• New embankments to be built for road alignment • New retaining structures
Highways features	• Road pavement • Road restraint systems such as safety barriers • Road lighting • Road markings and signs • Other roadside systems • Pedestrian and cycle routes
Landscape and vegetation	• Planting of native species
End Users	• Motorised users • Non-motorised users

Climate Baseline

15.4.30 The present-day climate baseline has been informed using a range of historical observed climate data sources (see the Data Sources section), which describe climate trends across the UK and Wales. Baseline data for the Scheme location covering the period 1981-2000 was obtained to provide context to the climate projections presented in the future climate baseline.

15.4.31 Values of projected future climate variables for the Scheme have been obtained from the Met Office UKCP18 UI which provides projections for future climate change across the UK against a range of future climate

scenarios. In line with the IEMA Guide to Climate Resilience and Adaptation (2020)[59], a 'precautionary approach' was taken by using the Representative Concentration Pathway (RCP) 8.5 (equivalent to a high emission scenario) from a baseline of 1981-2000. The 50th percentile values have been selected representing an 'as likely as not' probability of change[60]. The 10th and 90th percentile values are also presented as these represent a wider range of probabilities. UKCP18 Probabilistic projections for temperature and precipitation are available at a 25km^2 resolution. Values for the 25km^2 grid cell containing the Scheme (337500, 362500) have been obtained. The data presented includes annual and seasonal average values as well as extreme values for summer (June, July, August) and winter months (December, January, February).

15.4.32 DMRB LA 114[61] recommends the use of H++ scenarios used in UKCP09 which typically include projections in the 10th to 90th percentile range. However, as recommended by the IEMA Guide to Climate Resilience and Adaptation (2020)[62], use of UKCP18 is preferred as this supersedes UKCP09, offering the best available information on UK climate projections while also providing projections in the 10th to 90th percentile range.

15.4.33 Given the Scheme is located within the tidal extent of the River Dee, sea level rise projections have been obtained from UKCP18 Marine Projections against a 1981-2000 baseline for the grid square closest to the Scheme location (latitude(N): 53.39, longitude(E): -3.25) at the estuary of the River Dee. The RCP8.5 scenario and the 70th and 95th percentile has been used

[59] IEMA (2020). *IEMA EIA Guide to: Climate Change Resilience and Adaptation (2020*). [online] available: IEMA - IEMA EIA Guide to: Climate Change Resilience and Adaptation (2020) (last accessed January 2025).
[60] The 50th percentile is the median line in a probability bell curve of assembled climate model projection data, and as such represents the point at which it is as likely that climate outcomes will lie one side of this median line as the other side, hence the term 'as likely as not'.
[61] Standards for Highways (2021). *Design Manual for Roads and Bridges – Sustainability and Environment LA 114 (Climate).* [online] available: https://www.standardsforhighways.co.uk/dmrb/search/d1ec82f3-834b-4d5f-89c6-d7d7d299dce0 (last accessed January 2025).
[62] IEMA (2020). *IEMA EIA Guide to: Climate Change Resilience and Adaptation (2020.)* [online] available: IEMA - IEMA EIA Guide to: Climate Change Resilience and Adaptation (2020) (last accessed: January 2025).

to ensure alignment with the Welsh Government's guidance on Sea Level allowances[63].

15.4.34 Given the 120-year design life of the Scheme, and using the approach described above, the climate change scenarios for given time periods, as presented in Table 15-10 have been chosen for this assessment. Although the Scheme's lifetime extends beyond 2100, future climate projection data are not available beyond this time frame and data has been obtained based on the current availability of data.

Table 15-10 Future climate projection data

UKCP18 Product	Climate baseline time period	Future climate projection time period	Climate scenario	Percentile
Probabilistic Projections	1981-2010	2050s (2040-2059) 2090s (2080-2099)	RCP8.5	10th, 50th, 90th
Probabilistic Projections of Climate Extremes	N/A	2055, 2095	RCP8.5	10th, 50th, 90th
Marine Projections	1981-2000	2050, 2100	RCP8.5	70th, 95th
Local projections	1981-2010	2050s (2040-2059	RCP8.5	50th

Climate Change Risk Assessment

15.4.35 The CCRA is an assessment of the physical risks associated with future climate change on the Scheme.

15.4.36 Risks associated with climate change have been identified using the present-day and future climate baseline, alongside the Scheme's design and information from other environmental assessment topics. The risk assessment and determination of significance considers embedded resilience measures already incorporated within the Scheme design.

[63] Welsh Government (2022). *Adapting to Climate Change: Guidance for Flood and Coastal Erosion Risk*. [online] available: https://www.gov.wales/sites/default/files/publications/2022-11/guidance-for-flood-and-coastal-erosion-risk-management-authorities-in-wales_0.pdf (last accessed January 2025).

15.4.37 Risk in the context of climate risks is defined for this assessment as an effect which deviates from the expected, resulting from a response, or failure to respond, to a weather or climate related opportunity or threat[64]. Impacts due to weather and climate typically arise from two types of climate hazard:

a) Acute hazards - a sudden-onset hazard following a specific weather event such as a storm, such as damage to an asset.

b) Chronic hazard – a slow-onset hazard due to cumulative events over time, such as deterioration of a receptor below acceptable standards following years of changing seasonal weather.

Likelihood of Impacts

15.4.38 Risks are assessed by using professional judgement to assign likelihood and consequence ratings. The overall significance of the risk is determined using a significance matrix. Definitions of likelihood (Table 15-11 consequence (Table 15-12 and significance (Table 15-13 ratings are applied in line with DMRB LA 114 Climate and are set out in the following sections.

15.4.39 Likelihood is the probability and frequency of the potential impact occurring. The criteria for defining the likelihood of impacts from climate change on the Scheme are described in Table 15-11

15.4.40 Determination of the likelihood category is based on information from climate change projections, together with knowledge and professional judgement on the nature of the impacts and level of confidence associated with the projections. For example, there is a higher degree of confidence in temperature projections and lower confidence in projections of windspeed.

Table 15-11 Likelihood Categories

Likelihood category	Description (probability and frequency of occurrence)
Very high	The impact occurs multiple times during the lifetime of the project (120 years) e.g. approximately annually, typically 120 events.

[64] British Standards Institution (2019) Adaptation to climate change – Guidelines on vulnerability, impacts and risk assessment. (ISO Standard No. 14091:2019) Available at: www.iso.org/news/ref2625.html (last accessed: June 2025)

Likelihood category	Description (probability and frequency of occurrence)
High	The impact occurs several times during the lifetime of the project (120 years) e.g. approximately once every five years, typically 24 events.
Medium	The impact occurs limited times during the lifetime of the project (120 years) e.g. approximately once every 15 years, typically 8 events.
Low	The impact occurs during the lifetime of the project (120 years) e.g. once in 120 years.
Very low	The impact can occur once during the lifetime of the project (120 years).

Consequence of Impact

15.4.41 The measure of consequence is the level of disruption experienced by the receptor for a period of time and the receptors' ability to return to its normal functionality following the occurrence of a climate hazard.

15.4.42 The criteria for defining consequence of receptors due to climate hazards are described in Table 15-12 .

Table 15-12 Measure of Consequence

Consequence impact	Description
Very large adverse	Operation – national level (or greater) disruption to strategic route(s) lasting more than 1 week. Financial – financial loss exceeding £10 million. Safety – multiple fatalities or severe injuries. Reputation – severe damage to reputation at a national or international level, resulting in loss of stakeholder trust and long-term negative media coverage.
Large adverse	Operation – national level disruption to strategic route(s) lasting more than 1 day but less than 1 week or regional level disruption to strategic route(s) lasting more than 1 week. Financial – financial loss between £1 million and £10 million. Safety – single fatality or multiple serious injuries, leading to substantial legal action and regulatory scrutiny.

Consequence impact	Description
	Reputation –major damage to reputation at a national level, causing significant stakeholder concern and negative media coverage.
Moderate adverse	Operation – regional level disruption to strategic route(s) lasting more than 1 day but less than 1 week. Financial – financial loss between £100,000 and £1 million. Safety – serious injury or injuries, leading to legal action and regulatory scrutiny. Reputation – noticeable damage to reputation at a regional level, causing stakeholder concern and some negative media coverage.
Minor adverse	Operation – regional level disruption to strategic route(s) lasting less than 1 day. Financial – financial loss between £10,000 and £100,000. Safety – minor injury leading to internal investigation and minor regulatory scrutiny. Reputation – minor damage to reputation at a local level, causing limited stakeholder concern and minimal media coverage.
Negligible	Operation – disruption to an isolated section of a strategic route lasting less than 1 day. Financial – financial loss less than £10,000 Safety – minor injury with no significant legal or regulatory implications. Reputation – negligible damage to reputation, with no noticeable impact on stakeholder trust or media coverage.

Significance Matrix

15.4.43 Likelihood and consequence are combined to identify the significance of each risk identified as outlined in Table 15-13 . Significance is defined as Not Significant (NS) or Significant (S).

Table 15-13 Significance Matrix

		Measure of likelihood				
		Very low	**Low**	**Medium**	**High**	**Very high**
Measure of Consequence	Very large adverse	NS	S	S	S	S
	Large adverse	NS	NS	S	S	S
	Moderate adverse	NS	NS	S	S	S
	Minor adverse	NS	NS	NS	NS	NS
	Negligible	NS	NS	NS	NS	NS

In-combination Climate Change Impact Assessment

15.4.44 The impacts of the project in combination with climate change have been assessed for relevant environmental topics. This is important to consider the long-term cumulative effects are properly understood and mitigated. It complements the main climate risk assessment by providing a broader understanding of how project-related pressures may interact with evolving climate conditions, helping to identify cumulative risks and seek mitigation strategies that are robust and future-proof.

15.4.45 A qualitative assessment of the in-combination climate impacts was carried out in line with the IEMA Guide to Climate Resilience and Adaptation.[10] In-combination climate impacts describe where climate may exacerbate or diminish the effect of an existing impact of the project.[10] The assessment was based on professional judgement of the information available. The assessment includes:

a) Identification of the impacts on the Scheme that could change in combination with climate change.

b) Consideration of appropriate embedded mitigation measures.

c) Determine whether the effect is significant.

15.5 Baseline Conditions

Effects on Climate

Do minimum scenario

15.5.1 A Do-Minimum (DM) scenario is based on a realistic view of what is likely to happen in the absence of the Scheme proposals. The Do minimum scenario assumes the on-line replacement of the existing A494 River Dee bridge, as maintaining the current structure is not feasible due to significant structural defects that would likely necessitate full or partial closure in future. Such closure is incompatible with the Welsh Government's statutory obligations under the Highways Act 1980 and its commitment to maintaining a safe and reliable Strategic Road Network.

15.5.2 The DM baseline is presented over the 60-year appraisal period to allow direct comparison to the results of the Do-Something (with scheme) assessment. The following lifecycle stages are considered are within the DM:

a) Construction related traffic disruption due to restricted capacity
b) Operation energy
c) Operational maintenance and repair
d) Replacement
e) Operational road user emissions
f) Land use change emissions

15.5.3 The DM scenario assumes the extent of the bridge replacement work would be minimised to try and maintain some traffic on the route during construction. The scope of replacement work is assumed to be:

a) Remove existing reinforced concrete slab and replace with new slab.
b) Replace approach abutment slabs.
c) Existing steel beams repaired (if necessary) and repainted. Replacement of bearings and expansion joints.
d) Repair works to abutments.
e) Repair work and cathodic protection work to the river piers.

15.5.4 The emissions associated with construction have not been quantified. They are expected to be lower than the construction required for the new bridge and as such the assessment of the DS is considered a worst case scenario by comparing the construction emissions to a baseline of 0, whilst it is recognised there would be some level of emissions. This does not materially affect the assessment of significance or definition of mitigation.

15.5.5 Disruption due to the reasonable worst-case option from a traffic disruption perspective has been included during construction. The disruption to capacity on the bridge is shown to reduce total vehicle kilometres within the study area. As such indicates that under this scenario the emissions would be lower than if the bridge was fully functional. The table below shows the annual road user emissions during the 4 years of construction under the DM scenario.

Table 15-14 Construction-induced Road user emissions for DM scenario

	Year				Total
Scenario	**2027**	**2028**	**2029**	**2030**	
DM	297,800	291,504	285,209	279,333	1,153,846

15.5.6 Operational emissions for the DM and DS are assumed to be the same and assessed using the methodology as stated in 15.4. Operational emissions in the opening year account for the first-year operational energy, maintenance, repair, replacement, and land use change.

Table 15-15 Do minimum scenario emissions by lifecycle stage

Lifecycle stage	**60-year appraisal period**
Construction-induced Road user emissions	1,153,846
B2 Maintenance	176
B3 Repair	44
B4 Replacement	5,596

Lifecycle stage	60-year appraisal period
B6 Operational energy	41
Land use change	-12,695
Total	**1,147,008**

Vulnerability of the Scheme to Climate Change

Present-day Baseline

15.5.7 The present-day baseline uses observations from the UK land weather station network to describe the present climate across the UK and Wales. The baseline also includes localised climate observations from the Hawarden (Flintshire) climate station which is the closest station to the Scheme location.

15.5.8 The state of the UK Climate Report provides a description of trends that are consistent with a changing climate across the UK using observations from the UK land weather station network. Observations show that in 2023, the UK mean temperature was 9.97 °C which is 0.83 °C above the 1991-2020 long-term average. For Wales and Northern Ireland, 2023 was the warmest year on record (since 1884), whilst for England and Scotland, this was the second warmest year on record. Mean daily minimum temperatures were also at record highs in the UK in 2023 at 6.32°C, reaching 0.79°C above the 1991-2020 long-term average. The UK rainfall total for winter was 293mm which is 85% of the long-term average. However, for Wales, annual total rainfall ranked in the top 10 wettest years on record from 1836-2023. These observations show that the UK's climate is experiencing change beyond historical averages.

15.5.9 Additional climate trends for the UK are described in the headline findings of the report which include:

a) The UK's climate is changing with recent decades being warmer, wetter and sunnier than the 20th century.

b) All of the UK's top 10 warmest years from 1884 have occurred this century.

c) The UK's second warmest year (and warmest year for Wales), 2023, the warmest June, and the September heatwave were all made more likely by climate change.

d) The UK has warmed at a rate consistent with the observed change in global mean temperature over land.

e) The most recent decade (2014-2023) has been on average 2% wetter than 1991-2020 and 10% wetter than 1961-1990 for the UK overall.

f) The rate of sea-level rise in the UK is increasing, with the highest estimates of 4.6 ± 0.9 mm/year (1993-2023), indicating an acceleration of rate.

15.5.10 The latest UK CCRA3 report[65] outlines the following observed changes in climate for Wales in Table 15-16 . It is important to note that different baseline periods presented due to the availability of current climate trends as evidenced within UK CCRA3.

Table 15-16 Observed Changes in Climate in Wales

Climatic variable	Observed changes in Wales
Average annual land temperature	In the decade 2010-2019, average land temperatures have increased by 0.9 °C from the mid-1970s to mid-2010s.
Annual mean rainfall	Annual mean rainfall has increased by 2% in the decade 2010-2019 compared to the mid-1970s to mid-2010s.
Sunshine	Sunshine hours have increased on average by 6.1% in the decade 2010-2019 from the mid-1970s to mid-2010s.
Sea level rise	An approximate 1.4 mm per year in sea level rise has occurred since 1901 (16cm to date) across the UK.

15.5.11 The CCRA3 also notes the evidence of increases in extreme maximum summer temperatures as reflected by the number of record extreme monthly temperature records being set in the UK in the most recent decade. In July 2022, a record temperature record of 37.1 °C was recorded at Hawarden Airport in Flintshire, approximately 4 km from the Scheme location[66]. This

[65] Committee on Climate Change (2021). *CCRA3 – Regional Summary for Wales*. [online] available: https://www.ukclimaterisk.org/wp-content/uploads/2021/06/CCRA-Evidence-Report-Wales-Summary-Final.pdf (last accessed January 2025).

record remains the highest daily maximum temperature recorded for the north of Wales. Heatwaves are also becoming more common and extreme with the Met Office issuing their first ever red warning for heat in the lead up to the summer 2022 heatwaves. Heatwave thresholds in the UK vary by county and are defined as having been met when a location records a period of at least three consecutive days with daily maximum temperatures meeting or exceeding that temperature threshold [67]. The heatwave threshold for Flintshire, where the Scheme is located, is 25°C.[67]

15.5.12 The Met Office regional summary for Wales presents high-level climate observations over a 30-year averaging period between 1981-2010[68] using observations from the UK weather station network. These are presented in Table 15-17

Table 15-17 Observed Climatic Conditions for Wales (30-Year Average Between 1981-2010)

Climatic conditions	Climate observations
Temperature	Mean annual temperature varies from 9.5 °C to 11 °C. Variations in temperature depend on altitude (decrease of 0.5 °C for each 100 metres in increase in altitude). Mean daily minimum temperatures range from 0 °C to 4 °C during the winter months and the mean daily maximum temperatures range from 17 °C to 21 °C in the summer.
Rainfall	The months from October to January are significantly wetter than those between February and September. In north Wales, over 50 days with rainfall of more than 1 mm is the norm in winter (December to February) and over 35 days in summer (June to August).
Wind	Wales is one of the windier parts of the UK, with the windiest areas being over the highest ground and along the coasts, particularly those facing directions between the north-west and south. The frequency and strength of these depressions is greatest in the winter half of the year, especially from November to February, and this is

[67] Met Office *(n.d.)* What is a Heatwave? Available at: What is a heatwave? - Met Office (Accessed: June 2025)
[68] Met Office (2016). *Wales: climate.* [online] available at: https://www.metoffice.gov.uk/binaries/content/assets/metofficegovuk/pdf/weather/learn-about/uk-past-events/regional-climates/wales_-climate---met-office.pdf (last accessed January 2025).

Climatic conditions	Climate observations
	when mean speeds and gusts (short duration peak values) are strongest.
Sunshine	On average, Wales experiences the most sunshine in May and the least in December. Annual averages range from 1200 hours to 1750 hours, with durations of sunshine generally decreasing with increasing altitude in the mountainous areas.

Hawarden (Flintshire Climate Station)

15.5.13 The Hawarden (Flintshire) climate station (location: 53.174, -2.986) is the closest active station to the Scheme and describes localised conditions between 1991-2020. These observations are shown in Table 15-18 alongside values for Wales. Generally, the localised climate conditions are warmer and drier than the average across Wales.

Table 15-18 Hawarden (Flintshire) Climate Station Observations, 1991-2020

Climatic variables	Hawarden (Flintshire) climate stations	Wales
Annual Maximum temperature (°C)	14.32	12.93
Annual Minimum temperature (°C)	6.37	5.94
Annual Rainfall (mm)	728.74	1464.81
Annual Days of rainfall >1mm (days)	136.67	173.12
Annual Days of air frost (days)	42.32	44.92
Sunshine (hours)	1572.53	1407.46

Tidal Range and Storm Surge

15.5.14 The National Tide and Sea Level Facility presents historic and projected data for tides at Liverpool between 2008-2026 which is the closest data available

for the Scheme location[69]. Surge heights data between 1973-2012 is also available for Liverpool[70]. The ten lowest spring tides range from 0.22 metres above ordnance datum (mAOD) recorded in March 2015 and 2019 to 0.09 mAOD as recorded in March 2019. High spring tides have ranged from 10.24 mAOD as recorded in August 2014 to a maximum during this period of 10.37 mAOD as recorded in September 2015. The ten highest skew surges[71] range from 1.1 m in March 2004 to 1.570 m in January 2005, representing the additional height of storm surge water above the routine tide for those dates.

Recent Notable Climate Events

15.5.15 The Met Office provides a summary of past extreme weather events[72] experienced across the UK. Recent weather events which affected the Scheme location include:

a) Storm Éowyn (2025): Strong winds and heavy rain throughout much of the UK from 22nd January 2025. In Wales, the strongest gusts were seen in north Wales, where peak gusts of 60-70mph inland, with up to 80-90mph gusts along exposed coastal areas[73]. The A55 Britannia Bridge in the north-east of Wales was closed to all vehicles due to the hazardous driving conditions.[74]

b) Storm Darragh (2024): Widespread flooding throughout Flintshire in December 2024, resulting in fallen trees, road closures, and power outages. Wind gusts of over 55mph were recorded locally.

c) Storm Debi (2023): Strong winds and heavy rain in November 2023, with parts of North Wales some of the worst affected areas of the UK.[75] Intense

[69] National Tidal and Sea Level Facility (2022). *Highest & Lowest predicted tides at Liverpool.* [online] available: https://ntslf.org/tides/hilo?port=Liverpool (last accessed January 2025).
[70] National Tidal and Sea Level Facility (2022). *Skew surge history: England-West*. [online] available: Skew surge history: England – west | National Tidal and Sea Level Facility (last accessed January 2025).
[71] Skew surge is the difference between the maximum observed sea level and the maximum predicted tide regardless of their timing during the tidal cycle.
[72] Met Office (2025). *Past weather events.* [online] available: Past weather events - Met Office (last accessed January 2025).
[73] Met Office (2025). *News: Red weather warnings issues with damaging winds forecast for Storm Éowyn*. [online] available: Red weather warnings issued with damaging winds forecast for Storm Éowyn - Met Office (last accessed January 2025).
[74] North Wales Live (2025) Storm Éowyn: A55 Britannia Bridge closed as 90mph gusts hammer region. Available at: www.dailypost.co.uk/news/north-wales-news/storm-owyn-a55-britannia-bridge-30854392 (last accessed: June 2025)
[75] BBC (2023) Storm Debi: Strong winds and heavy rain hit UK. Available at: www.bbc.co.uk/news/uk-67396689 (last accessed: June 2025)

rainfall from 12 to 14 November saw over 50mm rainfall over upland areas of north Wales. The M48 Severn Bridge was affected with lane closures and reduced speed limits for 12 hours due to high winds.[76]

d) Storm Babet (2023): Heavy and persistent rain marked the third-wettest independent 3-day period for England and Wales since 1891. Flintshire County Council noted that the volume of water that fell within the county on 27th October 2023 overwhelmed infrastructure after more than 20 roads were forced to close[77].

e) Heatwave (2022): England and Wales experienced the hottest summer on record with parts of England exceeding 40 °C and a record of 37.1 °C set at Hawarden Airport in Flintshire, approximately 4km from the Scheme location[78]. The hot and dry conditions dried up rivers, damaged crops, exacerbated drought conditions and posed a substantial risk to human health.

f) Storm Franklin (2022): Following on a week after Storm Eunice and Storm Dudley, Storm Franklin brought high winds to the Flintshire. Gusts of around 57 miles per hour (mph) were recorded and the Flintshire bridge (A548) was closed as a result. Flood warnings were issued across the coast and areas along the River Dee in Flintshire due to rising water levels in the River Dee and Dee Estuary.

g) Storm Eunice and Storm Dudley (2022): Storm Eunice and Storm Dudley resulted in high winds and heavy rainfall with Eunice triggering red warnings issued by the Met Office. Areas across Flintshire were without power as a result.

h) Storm Dennis (2020): Strong winds and heavy rainfall were brought by Storm Dennis in February 2020. Strong winds lead to the closure of the M48 Severn Bridge eastbound, causing lasting disruption throughout the country.[79]

Future Baseline

15.5.16 Climate projections have been obtained for the Scheme location. The data is presented and summarised in the following sections.

[76] BBC (2023) Storm Debi: 77mph Aberdaron gusts after Wales wind warning. Available at: www.bbc.co.uk/news/uk-wales-67395739 (last accessed: June 2025)
[77] Flintshire County Council (2023). *Latest News*. [online] available: www.flintshire.gov.uk/en/Resident/Council-Apps/NewsPortlet.aspx?id=15586 (last accessed January 2025).
[78] Met Office (2022). *UK Climate Extremes.* [online] available: https://www.metoffice.gov.uk/research/climate/maps-and-data/uk-climate-extremes (last accessed January 2025).
[79] BBC (2020) Storm Dennis: Major incidents declared in south Wales and Herefordshire. Available at: www.bbc.co.uk/news/uk-51519635 (last accessed: June 2025)

Air Temperature

15.5.17 Air temperature projections are presented in Table 15-19 and Table 15-20 which shows that temperatures are projected to increase throughout the operational period. In the 2050s at the 50th percentile (Table 15-19 maximum temperatures in the summer are projected to increase by 2.2 °C and minimum temperatures in the winter projected to increase by 1.5 °C (relative to 1981-2000 baseline). In comparison, in the 2090s at the 50th percentile (Table 15-20 maximum temperatures in the summer are projected to increase by 5.5 °C and minimum temperatures in the winter projected to increase by 3.4 °C (relative to 1981-2000 baseline). This will lead to warmer winters and hotter summers. Extreme maximum temperatures (Table 15-21 are also projected to increase with extreme temperatures of up to 40.2 °C (1 in 100-year event) in 2095 at the 50th percentile. This is likely to increase the severity of summer heatwave events in the future.

Table 15-19 Temperature Projections for the Scheme Location (UKCP18 Probabilistic Projections, 1981-2000 Baseline, RCP8.5, 2040-2059)

Climate variable		Climate projections			
		1981-2000 Baseline	10th Percentile	50th Percentile	90th Percentile
Mean Air Temperature	Annual	10.0 °C	+0.8 °C	+1.6 °C	+2.5 °C
	Summer	15.5 °C	+0.7 °C	+2 °C	+3.3 °C
	Winter	4.6 °C	+0.4 °C	+1.4 °C	+2.6 °C
Mean Maximum Air Temperature	Annual	13.9 °C	+0.8 °C	+1.7 °C	+2.7 °C
	Summer	19.9 °C	+0.6 °C	+2.2 °C	+3.8 °C
	Winter	7.6 °C	+0.4 °C	+1.4 °C	+2.5 °C
Mean Minimum Air Temperature	Annual	6.2 °C	+0.7 °C	+1.6 °C	+2.5 °C
	Summer	11 °C	+0.8 °C	+1.8 °C	+2.9 °C
	Winter	1.6 °C	+0.4 °C	+1.5 °C	+2.8 °C

Table 15-20 Temperature Projections for the Scheme Location (UKCP18 Probabilistic Projections, 1981-2000 Baseline, RCP8.5, 2080-2099)

Climate variable		Climate projections			
		1981-2000 Baseline	10th Percentile	50th Percentile	90th Percentile
Mean Air Temperature	Annual	10.0 °C	+2.2 °C	+3.9 °C	+5.6 °C
	Summer	15.5 °C	+2.3 °C	+5 °C	+7.6 °C
	Winter	4.6 °C	+1.2 °C	+3.2 °C	+5.3 °C
Mean Maximum Air Temperature	Annual	13.9 °C	+2.2 °C	+4.0 °C	+5.9 °C
	Summer	19.9 °C	+2.3 °C	+5.5 °C	+8.8 °C
	Winter	7.6 °C	+1.2 °C	+3.2 °C	+5.2 °C
Mean Minimum Air Temperature	Annual	6.2 °C	+2.1 °C	+3.8 °C	+5.7 °C
	Summer	11 °C	+2.2 °C	+4.6 °C	+7 °C
	Winter	1.6 °C	+1.2 °C	+3.4 °C	+5.8 °C

Table 15-21 Extreme Temperature Projections for the Scheme Location (UKCP Probabilistic Extreme Projections, RCP8.5, 10th, 50th and 90th Percentile, 1 in 20, 1 in 50 and 1 in 100 Year Return Period, 2055 and 2095)

Climate variable		Climate projections			
		Return period	10th Percentile	50th Percentile	90th Percentile
Mean Maximum Air Temperature (2055)	Summer	1 in 20 years	32.8 °C	35.3 °C	38.3 °C
		1 in 50 years	33.5 °C	36.2 °C	39.3 °C
		1 in 100 years	33.9 °C	36.7 °C	40.1 °C
	Winter	1 in 20 years	16.8 °C	17.7 °C	18.7 °C
		1 in 50 years	17.3 °C	18.4 °C	19.7 °C
		1 in 100 years	17.6 °C	18.9 °C	20.5 °C

Climate variable		Climate projections			
		Return period	10th Percentile	50th Percentile	90th Percentile
Mean Maximum Air Temperature (2095)	Summer	1 in 20 years	33.5 °C	38.6 °C	44.5 °C
		1 in 50 years	34.1 °C	39.6 °C	45.8 °C
		1 in 100 years	34.5 °C	40.2 °C	46.6 °C
	Winter	1 in 20 years	18 °C	19.5 °C	21.4 °C
		1 in 50 years	18.5 °C	20.3 °C	22.5 °C
		1 in 100 years	18.9 °C	20.8 °C	23.4 °C

Precipitation and Rainfall Intensity

15.5.18 Precipitation projections are presented in Table 15-22 and Table 15-23 which show that precipitation patterns are projected to change in the Scheme location throughout the operational period. In the 2090s at the 50th percentile, precipitation in the summer is projected to decrease by 36.2% (relative to 1981-2000 baseline) but projected to increase in the winter by 12.2% (relative to the same baseline period). This will lead to drier summers and wetter winters. Drier summers may lead to an increased frequency and severity of drought events and wetter winters may increase risk of surface water flooding.

15.5.19 Extreme precipitation events in Wales may become more frequent and intense in the future[80]. During the summer months, despite there being an overall projected decrease in precipitation, intense rainfall events may be more severe in the form of summer storms with a 1-day total precipitation[81] of up to 62.1 mm (1 in 100-year event) and 5-day total precipitation[82] of 93.6 mm (1 in 100-year event) in 2095 at the 50th percentile. During the winter months, the increase in winter precipitation may intensify rainfall events with

[80] Committee on Climate Change (2021). *CCRA3 – Regional Summary for Wales.* [online] available: https://www.ukclimaterisk.org/wp-content/uploads/2021/06/CCRA-Evidence-Report-Wales-Summary-Final.pdf (last accessed January 2025).
[81] 1-day total precipitation is the largest precipitation total that falls within a single 24-hour day.
[82] 5-day total precipitation is the total precipitation that falls over a consecutive 5-day period.

up to a 1-day total precipitation of 44.2 mm (1 in 100-year event) and 5-day total precipitation of 79 mm (1 in 100-year event) in 2095 at the 50th percentile.

Table 15-22 Precipitation projections for the Scheme Location (UKCP18 Probabilistic Projections, 1981-2000 Baseline, RCP8.5, 2040-2059 and 2080-2099

Climate variable		Climate projections			
		1981-2000 Baseline	10th Percentile	50th Percentile	90th Percentile
Precipitation change (2050s)	Annual	756.7 mm	-9.4%	-1.9%	+5.6%
	Summer	6.3 mm	-37%	-14.7%	+6.8%
	Winter	5.7 mm	-3.8%	+4.7%	+13.9%
Precipitation change (2090s)	Annual	756.7 mm	-13.4%	-1.6%	+10.1%
	Summer	6.3 mm	-61.7%	-36.2%	-5.9%
	Winter	5.7 mm	-0.8%	+12.2%	+28.3%

Table 15-23 Extreme Precipitation Projections for the Scheme Location (UKCP Probabilistic Extreme Projections for 1-day total precipitation, RCP8.5, 10th, 50th and 90th Percentile, 1 in 20, 1 in 50 and 1 in 100-Year Return Period, 2055 and 2095, 2020 baseline provided)

Climate variable	Climate projections						
	Return period	Percentile	2020 (mm)	2055 (mm)	Change (2055) (mm)	2095 (mm)	Change (2095) (mm)
1-day total precipitation (Summer)	1 in 20 year	10th	35.3	34.5	-0.8	31.2	-4.1
		50th	40.8	41.9	+1.1	43.8	+3.0
		90th	48.0	51.3	+3.3	58.7	+10.7
	1 in 50 year	10th	40.7	40.2	-0.5	36.6	-4.1
		50th	49.9	51.5	+1.6	53.8	+3.9

Climate variable	Climate projections						
	Return period	Percentile	2020 (mm)	2055 (mm)	Change (2055) (mm)	2095 (mm)	Change (2095) (mm)
		90th	63.1	67.1	+4.0	77.2	+14.1
	1 in 100 year	10th	44.5	44.0	-0.5	40.6	-3.9
		50th	57.5	59.3	+1.8	62.1	+4.6
		90th	77.0	82.0	+5.0	94.4	+17.4
1-day total precipitation (Winter)	1 in 20 year	10th	24.8	26.4	+1.6	28.3	+3.5
		50th	27.7	30.4	+2.7	34.9	+7.2
		90th	31.2	35.3	+4.1	42.9	+11.7
	1 in 50 year	10th	27.6	29.4	+1.8	31.6	+4.0
		50th	32.0	35.1	+3.1	40.2	+8.2
		90th	37.9	42.5	+4.6	51.3	+13.4
	1 in 100 year	10th	29.4	31.4	+2.0	33.7	+4.3
		50th	35.3	38.7	+3.4	44.2	+8.9
		90th	43.7	48.7	+5.0	58.4	+14.7

Table 15-24 Extreme Precipitation Projections for the Scheme Location (UKCP Probabilistic Extreme Projections for 5-day total precipitation, RCP8.5, 10th, 50th and 90th Percentile, 1 in 20, 1 in 50 and 1 in 100-Year Return Period, 2055 and 2095, 2020 baseline provided)

Climate variable	Climate projections						
	Return period	Percentile	2020 (mm)	2055 (mm)	Change (2055) (mm)	2095 (mm)	Change (2095) (mm)
5-day total precipitation (Summer)	1 in 20 year	10th	72.9	69.1	-3.8	60.0	-12.9
		50th	78.8	79.7	+0.9	81.2	+2.4
		90th	85.2	92.2	+7.0	105.9	+20.7

Climate variable	Climate projections						
	Return period	**Percentile**	**2020 (mm)**	**2055 (mm)**	**Change (2055) (mm)**	**2095 (mm)**	**Change (2095) (mm)**
	1 in 50 year	10th	77.8	74.1	-3.7	65.2	-12.6
		50th	85.6	86.7	+1.1	89.0	+3.4
		90th	94.9	102.6	+7.7	118.0	+23.1
	1 in 100 year	10th	80.6	77.0	-3.6	68.2	-12.4
		50th	90.0	91.4	+1.4	93.6	+3.6
		90th	101.9	110.1	+8.2	127.0	+25.1
5-day total precipitation (Winter)	1 in 20 year	10th	53.5	55.7	+2.2	57.7	+4.2
		50th	57.6	61.4	+3.8	68.2	+10.6
		90th	62.8	69.8	+7.0	82.6	+19.8
	1 in 50 year	10th	57.1	59.5	+2.4	61.3	+4.2
		50th	63.3	67.4	+4.1	74.6	+11.3
		90th	71.8	79.5	+7.7	93.9	+22.1
	1 in 100 year	10th	59.4	61.9	+2.5	63.7	+4.3
		50th	67.6	72.0	+4.4	79.0	+11.4
		90th	79.4	87.6	+8.2	103.3	+23.9

15.5.20 The Welsh Government published updated guidance in September 2021[83] recommending climate change allowances to incorporate within development design to manage flood risk and improve resilience. Climate change allowances for peak rainfall intensity in the 2020s, 2050s and 2080s for Wales, in comparison to a 1961-1990 baseline, are reproduced in Table 15-25

[83] Welsh Government (2021). *Climate change allowances and flood consequence assessments*. [online] available: https://gov.wales/climate-change-allowances-and-flood-consequence-assessments (last accessed January 2025).

Table 15-25 Change to peak rainfall intensity (compared to a 1961-90 baseline)

Applies across all of Wales	Total potential change anticipated for 2020s (2015-2039)	Total potential change anticipated for 2050s (2040-2069)	Total potential change anticipated for 2080s (2070- 2115)
Upper estimate	10%	20%	40%
Central estimate	5%	10%	20%

Sea Level Rise

15.5.21 Sea level projections are presented in Table 15-26 which suggest that sea level is projected to increase throughout the Scheme's design life of up to an additional 1.04 m by 2100 at the 95th percentile (relative to 1991-2010 baseline). Given that the bridge receptors of the Scheme are located within the tidal reach of the River Dee, sea level rise may have an effect on the Scheme.

Table 15-26 Marine projections (UKCP18 Projections, 1981-2000 baseline, RCP8.5, 70th and 95th percentile, 2050 and 2100)

Variable	1991-2010 baseline		Marine Projections	
			70th Percentile	95th Percentile
Mean sea level rise	5.29m	2050	0.27m	0.35m
		2100	0.77m	1.04m

Lightning and Storms

15.5.22 While research into climate change impacts on lightning is uncertain, studies have been undertaken which show evidence of an increase in the frequency

of lightning strikes by 12% with each 1 °C average annual increase in air temperature[84].

15.5.23 Studies to understand climate change impacts on the frequency of storms, are uncertain. However, some studies have shown that increases in atmospheric carbon dioxide (CO_2) concentrations show a significant association with global increases in the frequency of intense flood and storm events[85]. Table 15-27 presents the projected wind speed for the Scheme location. Data has been obtained from the Met Office UKCP18 local (2.2km) projections covering the Scheme location. Due to availability of data, projections have been obtained only for the 2050s time period, and the 50th percentile.

Table 15-27 Local projections (UKCP18 2.2km, 1981-2010 baseline, RCP8.5, 50th percentile, 2050s time period)

Climate variable	Season	Baseline (1981-2010)	2050s (2040-2059)
Wind speed (m/s)	Summer	3.35	3.19
	Winter	4.45	4.29

15.6 Assessment Assumptions and Limitations

Effects on Climate

15.6.1 The following assumptions and limitations are relevant to this assessment:

a) The estimated material quantities derive from the BoQ provided by qualified quantity surveyors for the Scheme. Revision 01 (4th June 2025) of the Cost Plan BoQ is used. As the detailed design of the Scheme is to be completed, the final material quantities may differ from the estimated material quantities used in this chapter.

[84] Romps, D.M., Seeley, J.T., Vollaro, D. and Molinari, J. (2014). *Projected increase in lightning strikes in the United States due to global warming. Science. 346(6211), pp.851–854.* [online] available: https://science.sciencemag.org/content/346/6211/851 (last accessed January 2025).
[85] Lopez, R.E., Thomas, V. and Troncoso, P.A. (2020). *Impacts of Carbon Dioxide Emissions on Global Intense Hydrometeorological Disasters. Climate, Disaster and Development Journal. 4(1), pp.30-50.* [online] available: https://doi.org/10.18783/cddj.v004.i01.a03 (last accessed January 2025).

b) The NHCT was the primary tool used to supply emission factors for the embodied carbon assessment.

c) Materials without a direct match to the National Highways Carbon Estimating Tool are assessed using similar items based on professional judgement and the MCP.

d) In the absence of specific fuel consumption rates for plant machinery and equipment, the closest specifications according to professional judgement and industry practice are used.

e) RICS guidance emission factors have been used to calculate waste processing, recovery and disposal (landfill) rates arising from the demolition activities.

f) Construction waste emissions (stage A5) were calculated using the RICS guidance waste rates for materials.

g) In line with RICS methodology travel distances for the transport of materials (stage A4) were assumed to be sourced from local to national scales (i.e. within the UK) with distances varying between 20km and 120km from the construction site (with the exception of steel which has been assumed to be sourced from Europe). Travel distances will be updated once the procurement of materials is known.

h) Worker transport emissions are scoped out due to insufficient data.

i) In the absence of detailed information on an operational and maintenance schedule, maintenance (stage B2) is calculated as 1% of the construction lifecycle stages A1-A5, and repair (stage B3) is calculated as 25% of B2 impact.

j) Replacement impacts (stage B4) are based on the replacement cycle of assets. Assets are assumed to be replaced at the end of their DWL. DWLs are provided by the design team where available and default values from RICS guidance are used where not available.

k) End of life transport (stage C2) emissions are included in emission factors used in calculating end of life waste processing and disposal (stages C3 and C4).

l) A number of specific design components were omitted where information was not available, for example, due to level of design information available or where quantities of materials were not available. These include reuse of traffic signage and support fluid for abutment piles.

m) Land use change emissions only account for sequestration impacts and not the storage loss from removed habitats. Current land uses are majority man-made or heavily influenced and do not possess the same qualities as other natural wetlands that may contain higher levels of carbon and therefore considered to have insignificant emissions impact.

Vulnerability of the Scheme to Climate Change

15.6.2 This is based on freely available information available from third parties including observational data from local weather stations, publicly available climate change projections and a range of existing climate change datasets and literature at the time of writing this assessment. The following limitations and disclaimers should be noted:

a) Climate change projections: climate projections are not predictions or forecasts but simulations of potential scenarios of future climate under a range of hypothetical emissions scenarios and assumptions. The results, therefore, from the experiments performed by climate models cannot be treated as exact or factual, but projection options. They represent internally consistent representations of how the climate may evolve in response to a range of potential forcing scenarios and their reliability varies between climate variables.

   i) For a single emission scenario, projections can vary significantly as a function of the model used and how it is applied, so that there is a wide uncertainty band in the results. Scenarios exclude outlying “surprise” or “disaster” scenarios in the literature and any scenario necessarily includes subjective elements and is open to various interpretations.

   ii) Temperature projections more certain than those for precipitation. Furthermore, the degree of uncertainty associated with all climate change projections increases for projections further into the future. Climate models and associated projections are updated on a regular basis, implying changes in the forecasted future climate.

b) No climate modelling has been undertaken, relying solely on freely available data on climate projections in this region. Accordingly, any further research, analysis or decision-making should take account of the nature of the data sources and climate projections and should consider the range of literature, additional observational data, evidence and research available - and any recent developments in these.

15.7 Mitigation Measures

Effects on Climate

Construction

15.7.1 To integrate carbon management into the design process, a Carbon Management Plan (CMP) has been produced. This was developed to outline

key aspects for the design to follow to embed decarbonisation into the decision-making process. The CMP was designed in accordance with the key principles of PAS 2080, ensuring consideration of carbon reduction and in turn, design optimisation. This has included incorporating the carbon reduction hierarchy of 'avoid, switch and improve' as detailed below:

a) Avoid: align the outcomes of the project and/or programme of work with the net zero transition at the system level and evaluate the basic need at the asset and/or network level.

b) Switch: assess alternative solutions and then adopt one that reduces whole life emissions through alternative scope, design approach, materials, technologies for operational carbon reduction, among others, while satisfying the whole life performance requirements.

c) Improve: identify and adopt solutions and techniques that improve the use of resources and design life of an asset/network, including applying circular economy principles to assess materials/products in terms of their potential for reuse or recycling after end of life.

15.7.2 These principles were used as the basis for identifying carbon reduction opportunities in the Design for Resource Efficiency (D4RE) workshop held in August 2024. This workshop was supported by additional follow up sessions throughout the remainder of 2024. D4RE demonstrates the importance of design decisions in reducing carbon emissions, generation of waste and use of resources on projects. These can be reduced significantly using established and innovative techniques and through collaboration with clients, contractors and technical specialists as an integrated project team. D4RE involves idea generation on the primary theme of the Scheme's resource efficiency. The ideas are categorised by impact and ease of implementation. These ideas are then prioritised for further investigation and potential incorporation into the project.

15.7.3 The outcomes from the D4RE workshop are captured within the opportunities log within the CMP, acting as a live document updated as implementation of opportunities progresses through design development. Specific design mitigation examples from the D4RE workshop are outlined in the Materials Chapter 13 with key opportunities including:

a) Select single bridge design instead of dual bridge option

b) Designing out carbon-intensive cofferdam structures

c) Selecting a straight structure instead of curved to reduce material use

d) Limiting speed to 50mph for road users

e) Selecting the least disruptive construction process to traffic flows

15.7.4 The opportunities above were captured and progressed from optioneering to preliminary design and accounted for in the carbon assessment. Embedded mitigation measures, specifically ‘avoid’ solutions, has driven whole life carbon reduction for the Scheme. A focus on embedding ‘switch’ and ‘improve’ mitigation measures should be adopted as the Scheme progresses.

15.7.5 Further opportunities not yet implemented are captured within the opportunities log for further investigation as the design progresses. This includes that plant, equipment, and vehicles to be used on the Scheme would be selected based on their relative environmental performance taken from a technical specification.

15.7.6 Additional mitigation measures outlined within the Air Quality Chapter 11 should be followed in addition to those outlined in the Outline Construction Environment Management Plan (CEMP).

15.7.7 Additional road user modelling assessed the effectiveness of the Scheme against a speed limit reduction scenario. A sensitivity analysis was conducted for reducing the speed limit of the road to 50mph and determined that this would in turn reduce emissions. As a result, the design of the scheme has now embedded the 50mph limit for road users across the bridge. A reduction in speed limit is likely to reduce emissions as the design required for a 50mph speed limit is less intensive than if designed for a higher speed limit e.g. less volume of fill material as gradients and curves can be tighter.

15.7.8 Designing a procurement strategy with carbon reduction at its core is a critical mitigation measure for the Scheme. By embedding low-carbon principles into procurement processes, the scheme ensures that materials, services, and construction methods are selected based on their

environmental performance. Through the design stage the designer is supporting the establishment of the procurement route and documentation required for tender This includes seeking to embed requirements within the tender for the successful tenderer to hold PAS 2080 certification, specification of a Carbon Manager for the project, and setting of target carbon value through to align with the target cost value approach.

Vulnerability of the Scheme to Climate Change

Operation: Embedded mitigation measures

15.7.9 The Scheme includes a range of measures that are embedded into the design, which enhance the resilience of the Scheme to the impacts of climate change. The embedded mitigation measures have been taken into account within the assessment of risks from climate change and identification of significance.

Structural and highways design

15.7.10 The Scheme's design is in line with the latest structural design code which, following consultation with the design team, is believed to be sufficient in providing resilience from the impacts of climate change. These include:

a) Wind loads determined in accordance with BS EN 1991-1-1-4 and corresponding UK National Annex[86].

b) Thermal actions determined in accordance with BS EN 1991-1-5 and the corresponding UK National Annex[87].

c) Headroom of the bridges over the River Dee shall be no less than existing bridge headroom, maintaining passage for boats underneath the bridge.

d) Power cables for highways lighting and electronic signage would be buried, which ensures protection from above-ground climate events.

e) The design considers the potential use of either WG SMA (Welsh Government Stone Mastic Asphalt) or HRA (Hot Rolled Asphalt) mixes. Both

[86] BSI (2004). *BS EN 1991-1-5 Eurocode 1. Actions on Structures. Thermal Actions.* [online] available: BS EN 1991-1-5 - Eurocode 1. Actions on structures. General actions. Thermal actions (bsigroup.com) (last accessed January 2025).
[87] BSI (2004). *BS EN 1991-1-5 Eurocode 1. Actions on Structures. Wind Actions.* [online] available: BS EN 1991-1-4 - Eurocode 1. Actions on structures. General actions. Wind actions (bsigroup.com) (last accessed January 2025).

mixes provide resilience to changes in precipitation and temperature. However, it is considered that WG SMA surfacing is less susceptible to extreme climate change when compared to HRA. The mixes are resilient to cracking and rutting of surface, resistant to moisture damage and have skidding resistance.

Flood risk and drainage design

15.7.11 The Scheme's design is in line with DMRB CG 501 – Design of highway drainage systems[88]which stipulates that the design should include an assessment of and mitigation against the potential impacts of climate change. This also includes the use of the latest climate change allowances in accordance with relevant national policy. As such, the following measures are included in the flood risk and drainage design of the Scheme which provides resilience from the impacts of climate change:

a) Proposed new outfall designed up to a 1 in 100-year return period with a 40% climate change uplift factor. New outfall will be fitted with a non-return valve to prevent backflow from the Queensferry drain entering the highway drainage system.

b) Proposed drainage has been modelled and designed using 0.1% Annual Exceedance Probability (AEP) fluvial event and 0.1% AEP tidal event with climate change in 2095 scenarios. Modelling also included scenarios with both a 20% (central) and a 45% (upper) allowance for climate change.

c) Incorporation of appropriate SuDS into the A494 highway drainage system to mitigate risk of surface water flooding.

d) Gulley spacings are designed to CD 256, ensuring efficient drainage of surface water.

e) Realignment of the Queensferry Drain to mitigate risk of surface water flooding.

f) Groundwater discharge system with filter in place at the new railway underbridge where there is potential for groundwater flooding.

g) Design groundwater level of 4.5 mAOD for the new railway underbridge and 5 mAOD for the Eastbound and Westbound River Dee Bridges to be adopted which includes allowance for climate change.

h) The Scheme location is already protected by existing flood defence embankments.

[88] National Highways (2022). *CG 501 – Design of highway drainage systems.* [online] available: CG 501 - Design of highway drainage systems - DMRB (standardsforhighways.co.uk) (last accessed January 2025).

i) Proposed flood wall along Queensferry drain next to Makro to prevent water overtopping from both the Queensferry Drain open channel and the River Dee onto the A494 Westbound carriageway during extreme events.

j) Three pumping stations will be constructed along with associated electrical substations to mitigate risk of flooding. Discharge rates are to be agreed with National Resources Wales. (Relocation of the existing Queensferry Drain pump station; Construction of a new A494 Highways drainage pump station; Construction of a new pumping station for groundwater at the new railway underbridge).

k) All electrical, instrumentation, control and automation equipment and generators for pumping stations and electrical substations will be placed on raised platforms above flood levels of 7.63 mAOD as minimum (based on overtopping event of 7.33 mAOD for the 0.1% AEP with climate change uplift scenarios).

l) Electrical substations will have both a fuel tank and generator as back-up in the event of power loss.

m) New culvert to be constructed with a large diameter (1.5 m) that is assessed to be of ‘low risk’ of blockage. The culvert will also have a trash screen and a maintenance regime to prevent blockage.

n) Water level sensors to be installed along Queensferry Drain for pump activation and can serve as a warning system for potential blockage of culverts and enable reactive maintenance.

Shared use pedestrian and cycle path

15.7.12 The proposed shared use paths have been modelled and designed with consideration of climate change scenarios (flood modelling with climate change scenarios RCP8.5, 70th and 95th percentile used for low and high levels as well as RCP8.5, 70th percentile to 2146 for extreme flood levels). Flood modelling suggests the proposed paths will be flood free from Mean High Water Spring Tide levels to 2146 but would be susceptible to extreme event flooding. To reduce this risk, the path levels will be raised between 0.5 m and 1.5 m to enhance resilience.

Maintenance and management

15.7.13 The Scheme will follow the Welsh Government Trunk Roads Maintenance Manual (TRMM) which sets out the approach to maintenance, inspection, defect repairs and winter maintenance. The maintenance and management regime includes:

a) General inspections at two-year intervals with principal inspections at six-year intervals.

b) Highways maintenance will be in accordance with the Welsh Government TRMM.

c) Maintenance painting operations.

d) Inspection to be undertaken following 1 in 1000-year flood event of the River Dee to check bridge bearings.

e) Inspection in the aftermath of any vessel impact with proposed bridges.

f) Inspections following gale force winds (88-117km/h) to assess damage and identify fallen trees or large debris.

g) Flood warnings provided for the Scheme location.

h) New Flood Emergency Plan will be developed to form part of wider over-arching contingency plan for highway incidents.

i) Provision of telemetry and CCTV systems to monitor water levels and blockages at the Queensferry Drain open channel and central reserve highway open channel.

j) Maintenance aftercare for landscape elements would be carried out by the Contractor for a period of five years. Aftercare would involve tasks such as grass cutting, weed control, replacement of dead plants and repair of fences.

k) There will be routine annual maintenance for the environmental elements of the Scheme.

l) trigger levels and response to these events.

15.8 Assessment of Effects

Effects on Climate

Construction

15.8.1 *Emissions from Construction Processes*

15.8.2 The carbon assessment for the construction stage has indicated that the Scheme would result in emissions of approximately 19,460 tCO_2e. The embodied carbon emissions from the products and materials (stages A1-3) make up the majority of the construction emissions at 67%, construction activities (A5.2) making up 18%, transport (A4) with 9% while waste

management (A5.3) and pre-construction demolition (A5.1) make up 4% and 2% respectively, see breakdown in Table 15-28 .

Table 15-28 Construction Stage Emissions

Lifecyle Stage	Carbon emissions (tCO_2e)[89]	Percentage of total construction carbon
A1-3 Products and materials	13,120	67%
A4 Transport	1,760	9%
A5.1 Pre-construction demolition	330	2%
A5.2 Construction activities	3,460	18%
A5.3 Waste and waste management	800	4%
Total	**19,460**	**100%**

15.8.3 Emissions From Road Users During Construction

15.8.4 As described in Section 15.5, the DM will result in different traffic management to the DS and as such the emissions from road users during the construction period are different. During the construction stage the Scheme is estimated to have a net increase of 1,440 tCO_2e compared to the do-minimum (without Scheme) scenario. This is based on applying the preferred CT3 scenario. The CT3 scenario involves traffic flowing on both sides of the road, although reduced to single lanes.

15.8.5 The DM scenario will require construction on the existing bridge and as such temporary traffic measures (significant diversion routes) are expected to reduce the number of vehicles travelling and therefore lead to lower emissions. Rerouting of regular traffic flows disrupts regular route patterns, particularly for Heavy Duty Vehicles which divert to A55 or Flincher bridge alternative routes. Cars and LGVs are able to reroute on all three adjacent routes. Cordons around the affected road network prevents some traffic from

[89] Figures are rounded to the nearest 10 tonnes.

entering the route, only minor levels of suppressed traffic are noted for cars with an overall decrease in flow. Whilst reduced travel by restricting volume of traffic is positive for a carbon perspective, it has negative socio-economic consequences and as such is not a viable option, therefore is considered the do-minimum.

Table 15-29 Proposed Scheme Construction Period Road User Assessment

Construction year	Do minimum (tCO_2e)	Do something (tCO_2e)	Net CO_2e project GHG emissions (tCO_2e) (Do something – Do minimum)
2027	297,800	298,310	510
2028	291,500	291,980	480
2029	285,210	285,660	450
2030	279,330	279,330	0
Total	**1,153,840**	**1,155,280**	**1,440**

15.8.6 Overall Construction Emissions

15.8.7 As seen in Table 15-30 15.8.3below, compared against a DM current baseline, there is a net increase in emissions of 20,890 tCO_2e for the Scheme, which accounts for A1-5 and construction-induced road user emissions. Net CO_2e is likely to be lower as there will be significant construction emissions for a Do minimum scenario. The net increase in emissions between DM and DS is due to the differences in traffic management: the DM involves traffic management which is assumed to reduce total vehicle trips; the DS has no traffic management as the existing bridge remains open during the construction period.

Table 15-30 Net project emissions (construction)

Lifecyle Stage	Do minimum (DM) construction baseline (tCO_2e)	Do something (DS) opening year (tCO_2e)	Net CO_2e project GHG emissions (tCO_2e) (Do something – Do minimum)
A1- A5 construction emissions	0	19,460	19,460
Construction-induced Road user emissions	1,153,840	1,155,280	1,430
Total	**1,153,840**	**1,174,740**	**20,890**

15.8.8 Although there is a net increase in construction emissions, the wider benefits beyond the carbon impact should also be considered. The Scheme aims to deliver opportunities for modal shift through better provisions for alternative modes, maintaining and enhancing local environment through securing long term net benefit for biodiversity and connectivity along the A494 strategic corridor during construction to minimise impacts on residents, businesses, strategic and local traffic.

15.8.9 Embedding carbon into the design process, including assessing a shortlist of options and producing the Carbon Management Plan as set out in Section 15.7, have led to carbon reductions as the Scheme has developed. This aligns the Scheme development with Welsh Government policy such Section 3 and 4 of the Environment (Wales) Act 2016 which state that public bodies must apply principles of sustainable management of natural resources when exercising their functions, which includes planning and delivering infrastructure projects like transport schemes.

15.8.10 At every design stage, these measures aim to be integrated into the design to reduce upfront construction emissions. This aligns the Scheme with the condition "*The scheme should minimise carbon emissions in construction*" as

defined by the Roads Review Panel in The Future of Road Investment in Wales[90]

15.8.11 The total construction emissions account for 0.016% of the estimated Wales Carbon Budget 3 (118 $MtCO_2e$), and 0.0011% of the estimated 5th UK carbon budget (1,725 $MtCO_2e$). This level of emissions compared to the Welsh and UK carbon budgets is less than 0.02% of the total budget.

Operation

15.8.12 The operational (maintenance, repair, and operational energy use) stage emissions are assumed to be the same for the Do minimum and Do something scenario, therefore, the net emissions over these stages for the future baseline remain zero. There is a net increase in land use change emissions due to reduction in land area of certain habitats. This is presented in Table 15-31 . The majority of the land use change emissions are due to reduction in land area for running water and saltmarsh habitats. There are also net reductions in the land area for neutral grassland, ruderal, and scrub habitats which contribute a small increase in emissions.

Table 15-31 Net project emissions (operation)

Lifecyle Stage	Do min baseline (60-year appraisal) (tCO_2e)	Do something (60-year appraisal) (tCO_2e)	Net CO_2e project GHG emissions (tCO_2e) (Do something – Do minimum)
B2 Maintenance	180	180	0
B3 Repair	40	40	0
B4 Replacement	5,600	5,600	0
B6 Operational	40	40	0
Land use change	-12,690	-10,430	2,260
Total	**-6,830**	**-4,570**	**2,260**

[90] Welsh Government (2021) The Future of Road Investment in Wales. [online] available at: The Future of Road Investment in Wales

15.8.13 The Scheme aligns with key Welsh Government climate and transport policies, including the *Environment (Wales) Act 2016*, *Net Zero Wales*, *Prosperity for All: A Low Carbon Wales*, and the *National Transport Delivery Plan 2022–2027*. While the Scheme is not expected to result in a net increase in operational emissions, a minor rise is anticipated due to land use change. However, the Scheme offers wider climate benefits by supporting modal shift through enhanced active travel infrastructure. This includes reducing severance at the railway bridge and improving connectivity to the coastal cycleway, thereby complementing other local schemes aimed at reducing car dependency. These measures contribute to the Welsh Government's statutory emissions reduction targets and sustainable transport objectives, while also supporting climate adaptation and resilience in line with the *Climate Adaptation Strategy for Wales 2024*.

15.8.14 Consideration has been given to the Sustainable Transport Hierarchy defined within the Wales Transport Strategy. This has encouraged that options which would have resulted in the generation of additional traffic were not progressed to the Stage 2 appraisal, aligning the Scheme with the condition "The scheme should not increase road capacity for cars" in The Future of Road Investment in Wales.

15.8.15 The Scheme (offline bridge replacement) has the same mainline carriageway capacity (two lanes in each direction) and design speeds (50mph) as the existing bridge. Therefore, the Scheme does not provide any additional capacity to highway vehicle users. Traffic conditions are effectively the same following scheme opening between an online and offline bridge replacement scheme. The Scheme does not promote additional highway vehicle use compared to the Do minimum scenario (online replacement), and this is in accordance with Welsh Transport Policy objectives (not providing additional road capacity as part of transport schemes that would facilitate the increased usage of private vehicles (induced trips)).

15.8.16 The operational impact is assessed over a 60-year reference period. After the opening year of 2031, the operational impact is less than 0.00002% of the UK's 5th Carbon Budget and less than 0.000001% of the 6th Carbon Budget (2033-2037).

Whole life carbon

15.8.17 As per the DMRB LA 114, results are presented in Table 15-32 by construction and operation and compared against the relevant carbon budgets. Emissions are reported against a carbon budget and period in which they would occur. Operational emissions have been assessed for a 60-year appraisal period, however as this extends beyond the scope of the carbon budgets they will be compared against the last UK budget (6th Carbon budget) and the last Wales Carbon Budget/target (2040 target), the table below compares emissions up to the year 2037.

Table 15-32 Project GHG emissions against relevant carbon budgets

Project stage	Estimated total carbon over carbon budget (tCO_2e) ('Do something' Scenario)	Net CO2 project GHG emissions (tCO_2e) (Do something - Do minimum)	Relevant carbon budget (tCO_2e)		
			5th Carbon budget (2028-2032)[91]	6th Carbon budget (2033-2037)	2040 target
Construction	1,174,740	20,890	1,725,000,000		
Operation	950	260		965,000,000	21,000,000
Total	**1,175,690**	**20,630**			

15.8.18 Construction emissions account for only 0.000001% of the 5th Carbon Budget. Operation emissions account for less than 0.0012% of the 2040 target and 0.00003% of the 6th Carbon budget. As stated in the previous sections, the Scheme proposes to deliver wider benefits outside of carbon

[91] The construction period for the Scheme is anticipated to take place between 2027 to 2031 which places the Scheme construction period across the 4th and 5th UK carbon budget. However, as a worst-case scenario, it has been assumed all construction of the Scheme will take place in the 5th UK carbon budget period (2028-2030).

reduction. Embedded mitigation measures are being adopted and whole life carbon considered, with the development of the Scheme aligning with Welsh Government policy on decarbonisation and transport.

15.8.19 The end-of-life emissions were assessed for this Scheme and results in an impact of 1,005 tCO_2e. However, as end-of-life emissions fall outside of the scope of current carbon budgets, given the long design life of the Scheme, they are not reported in the above table. End-of-life emissions can be considered as a worst-case scenario, as at the time they occur, both the UK and Wales are expected to have achieved net zero, with the carbon impact at that stage likely mitigated through future decarbonisation measures.

Vulnerability of the Scheme to Climate Change

Construction

15.8.20 The construction phase of the Scheme will be vulnerable to weather impacts associated with the current climate.

15.8.21 Extreme weather events, such as storms, high winds, and heatwaves may pose a risk to construction activities. These events can cause physical damage to partially completed structures, equipment, and materials. They may also lead to work stoppages, delays in project timelines, and increased costs due to the need for repairs, rescheduling, and additional safety measures. Furthermore, extreme weather can lead to health and safety issues for workers, particularly in exposed or elevated work environments.

15.8.22 Sustained periods of high temperatures and dry conditions can exacerbate dust generation and dispersion on construction sites, reducing air quality and visibility. Periods of drought and water scarcity can additionally pose challenges to dust suppression. This may have an effect on worker health, particularly respiratory health. Heat stress and dehydration may potentially reduce workforce productivity and increasing the likelihood of heat-related illnesses or accidents, both on-site and especially for outdoor workers, and travelling to and from site.

15.8.23 Heavy rainfall events can lead to site flooding, soil erosion, and waterlogging, which can disrupt construction schedules and damage construction materials and infrastructure. These conditions may also compromise the stability of temporary works and excavations, increasing the risk of landslides and ground movement. Additionally, heavy rainfall may disrupt the transportation and delivery of materials, leading to supply chain disruptions and further delays. Overland flows and localised flooding due to heavy rainfall can specifically affect fuel and chemical storage, leading to increased likelihood of pollution events, and can also affect access routes.

Operation

15.8.24 The potential effects of climate change during operation on the Scheme receptors identified in Table 15-9 have been assessed in Table 15-33 These effects have been assigned a significance rating based on the measure of consequence and likelihood of climate events occurring following the consideration of embedded mitigation measures. An assessment of in-combination climate impacts is presented in Table 15-34 which considers climate impacts across other environmental topics. A summary of impacts is described below, the full assessment of significance can be found in Table 15-33 .

Summary of impacts to bridges

15.8.25 Bridges are anticipated to experience impacts from both high and low temperature extremes. Increasing summer temperatures may lead to thermal expansion of joints and potential bearing failure. Conversely, although freeze-thaw cycles are expected to reduce due to milder winters, occasional low temperatures could still cause erosion, cracking, and spalling of structural elements.

15.8.26 Rising winter precipitation and more frequent extreme rainfall events pose several risks to bridge infrastructure. These include accelerated deterioration of joints, damage to bridge deck surfaces, and reduced skid resistance. Flooding from surface water, groundwater, and rising sea levels

presents a significant challenge. Potential impacts include disruption to bridge access, scour of bridge piers and foundations, and impeded boat navigation under bridges.

15.8.27 Changes in precipitation patterns, including droughts and subsequent heavy rainfall, may lead to soil shrinkage, cracking, and increased moisture content, all of which can compromise the stability of bridge foundations. Finally, high winds and storm events may necessitate temporary closures of bridges to ensure the safety of both motorised and non-motorised users.

Summary of impacts to drainage

15.8.28 Under future climate scenarios, the risk of drainage pipes freezing and bursting due to low temperatures is anticipated to decrease, as mean annual and winter temperatures rise. The Scheme is exposed to multiple sources of flooding, including tidal and fluvial flooding from the River Dee and the Queensferry Drain. Tidal flooding is considered the most significant risk. Extreme precipitation events may overwhelm the drainage system, accelerate asset degradation, and increase the risk of surface water flooding and pipe bursts.

15.8.29 Decreasing summer precipitation and drought conditions may lead to blockages in the drainage system, requiring more frequent maintenance. High winds and storm events can lead to blockages in drainage and culverts due to debris accumulation.

Summary of impacts to earthworks

15.8.30 Rising summer temperatures, extreme heat, and reduced precipitation are anticipated to increase the risk of soil drying, shrinkage, and cracking. These conditions can lead to soil creep and instability of earthwork slopes, as well as potential failure of embankments.

15.8.31 Increased winter precipitation and extreme rainfall events may raise groundwater levels, triggering ground movements such as earthwork slips.

Additionally, rising sea levels and higher flows in the River Dee could lead to scour of embankments. High winds may cause tree fall and damage to vegetation on embankments, exposing soil and increasing the risk of erosion.

Summary of impacts to highway features

15.8.32 Highway features such as road pavements, pedestrian and cycle routes are vulnerable to extreme temperatures, particularly during summer. Rising temperatures may lead to surface failure through thermal expansion, cracking, melting, and deformation of asphalt. Additionally, high temperatures may limit the ability to carry out maintenance activities.

15.8.33 Increasing winter precipitation and extreme rainfall events may reduce skid resistance on road surfaces and lead to surface water flooding, causing disruption and potential road closures. There is also a risk of increased sub-surface moisture weakening highway foundations.

15.8.34 High winds and storm events pose a threat to roadside infrastructure such as safety barriers, lighting, signage, and road markings. These assets may suffer damage or deterioration due to wind loading and storm exposure.

Summary of impacts to landscape vegetation

15.8.35 Rising and extreme summer temperatures, combined with reduced precipitation, may negatively affect the establishment and long-term survival of vegetation planted as part of the Scheme. These conditions could reduce the success of landscaping efforts, particularly during the early stages of growth.

15.8.36 A proposed enhancement area of saltmarsh downstream of the Scheme is intended to compensate for habitat loss during construction. Although the current condition of this area is good, it is being monitored for changes. Sea level rise and temperature increases could affect the success of this enhancement feature if implemented.

Summary of impacts to users

15.8.37 Motorised travellers may face reduced visibility during periods of increased precipitation and extreme rainfall, which could elevate the risk of accidents.

15.8.38 For pedestrians and cyclists, extreme temperatures may reduce the frequency of snow and ice events, lowering the risk of slippery surfaces. However, cold spells may still occur. Increased winter precipitation and extreme rainfall events could reduce surface grip on cycleways and footpaths, affecting both actual and perceived safety.

Table 15-33 Assessment of Likely Effects from Climate Change

Receptor	Climate variable	Climate hazard	Potential impacts	Embedded mitigation	Likelihood	Consequence	Significance of effect
Bridges	Temperature	Increasing temperatures (summer) Extreme temperatures	Thermal expansion of joints and bearing failure.	The Scheme's design is in line with the latest structural design code (BS EN 1991-1-5) which, following consultation with the design team, is believed to be sufficient in providing resilience from the impacts of climate change. The Scheme includes a monitoring and management regime which consists of regular general inspections and principal inspections of structures. Refer to the Embedded Mitigation Section for further information.	Low	Moderate adverse	NS
Bridges	Temperature	Low temperatures	The occurrence of freeze-thaw events will likely be reduced as a result of increasing winter temperatures However, the risk may still occur during periods of low temperatures. These freeze-thaw events could lead to erosion, cracking and spalling of the structure.	The Scheme's design is in line with the latest structural design code (BS EN 1991-1-1-5) which includes consideration for temperature. The Scheme includes a monitoring and management regime which consists of regular general inspections and principal inspections of structures. Refer to the Embedded Mitigation Section for further information.	Very low	Minor adverse	NS

Receptor	Climate variable	Climate hazard	Potential impacts	Embedded mitigation	Likelihood	Consequence	Significance of effect
Bridges	Precipitation	Increasing precipitation (winter) Extreme precipitation events	Increased deterioration rates for joints. More frequent maintenance and replacement may be required.	The Scheme includes a monitoring and management regime which consists of regular general inspections and principal inspections of structures. Refer to the Embedded Mitigation Section for further information.	Medium	Minor adverse	NS
Bridges	Precipitation	Increasing precipitation (winter) Extreme precipitation events	Increased damage to bridge deck surface. More frequent maintenance and replacement may be required.	The design considers the potential use of either Stone Mastic Asphalt, or Hot Rolled Asphalt (HRA) mixes. Both mixes provide resilience to changes in precipitation with HRA used as a bridge deck waterproofing material as it is resistant to moisture damage. Refer to the Embedded Mitigation section for further information.	Medium	Minor adverse	NS
Bridges	Precipitation	Increasing precipitation (winter) Extreme precipitation events Flooding	Surface water flooding as a result of increased precipitation and extreme precipitation events, leading to disruption and closure of bridges and shared use paths.	The Scheme includes a comprehensive flood risk and drainage design which is in line with DMRB guidance and has been modelled and designed with consideration of climate change allowances. Measures include new outfall with non-return valve, new flood wall, three pumping stations, new culvert and installation of water level sensors and use of SuDS. Shared use paths have been modelled and designed with consideration of climate change. Path levels will be raised between 0.5 m and 1.5 m	High	Minor adverse	NS

Receptor	Climate variable	Climate hazard	Potential impacts	Embedded mitigation	Likelihood	Consequence	Significance of effect
				Refer to the Embedded Mitigation Section for further information.			
Bridges	Precipitation	Increasing precipitation (winter)	increase in sub-surface moisture content, potentially reducing the strength of bridge foundations.	The Scheme includes a comprehensive flood risk and drainage design which is in line with DMRB guidance and has been modelled and designed with consideration of climate change allowances. Measures include new outfall with non-return valve, new flood wall, three pumping stations, new culvert and installation of water level sensors and use of SuDS. The Scheme includes a monitoring and management regime which consists of regular general inspections and principal inspections of structures. Refer to the Embedded Mitigation Section for further information.	Low	Moderate adverse	NS
Bridges	Precipitation	Decreasing precipitation (summer) Droughts	Drought causing soil shrinkage and cracking of foundations/bridge.	The Scheme includes a monitoring and management regime which consists of regular general inspections and principal inspections of structures. Refer to the Embedded Mitigation Section for further information.	Medium	Moderate adverse	NS
Bridges	Precipitation	Drought followed by heavy precipitation (summer)	Drought followed by heavy rainfall leading to soil cracking, leading to a route for water to reach bridge foundations and ultimate destabilisation.	The Scheme includes a monitoring and management regime which consists of regular general inspections and principal inspections of structures. Refer to the Embedded Mitigation Section for further information.	Medium	Moderate adverse	NS
Bridges		Extreme precipitation events Increasing precipitation (winter)	Heavy rain leading to groundwater flooding affecting bridge foundations.	The Scheme includes a monitoring and management regime which consists of regular general inspections and principal inspections of structures.	Medium	Moderate adverse	NS

Receptor	Climate variable	Climate hazard	Potential impacts	Embedded mitigation	Likelihood	Consequence	Significance of effect
				Refer to the Embedded Mitigation Section for further information.			
Bridges	Precipitation	Flooding Extreme precipitation events	Increased sea level and higher flow in the River Dee following extreme precipitation events could result in scour of bridge piers.	The Scheme includes a monitoring and management regime which consists of regular general inspections and principal inspections of structures. Refer to the Embedded Mitigation Section for further information.	Medium	Minor adverse	NS
Bridges	Precipitation	Flooding Extreme precipitation events	Boat access under the bridges may be impeded as a result of sea level rise and high flows due to heavy precipitation events.	The Scheme's structural design maintains headroom over the River Dee to ensure boat access. Refer to the Embedded Mitigation Section for further information.	Low	Moderate adverse	NS
Bridges	Precipitation	Flooding Increasing precipitation (winter)	Rising sea levels and increase in winter precipitation could lead to flooding of the bridges.	The Scheme includes a comprehensive flood risk and drainage design which is in line with DMRB guidance and has been modelled and designed with consideration of climate change allowances. Measures include new pump station for the new railway underbridge for groundwater levels, groundwater discharge system with filter in place, and a design groundwater level of 4.5 mAOD for the new railway underbridge and 5 mAOD for the River Dee Bridges which includes climate change allowances. Refer to the Embedded Mitigation Section for further information.	Medium	Minor adverse	NS
Bridges	Precipitation	Increasing precipitation (winter) Extreme precipitation events	Increase in average precipitation may lead to reduced skid resistance of bridge surface.	The design considers the potential use of either WG SMA or HRA asphalt mixes. Both mixes provide resilience to changes in precipitation and are treated to enhance skid resistance. Refer to the Embedded Mitigation Section for further information.	Low	Minor adverse	NS

Receptor	Climate variable	Climate hazard	Potential impacts	Embedded mitigation	Likelihood	Consequence	Significance of effect
Bridges	Precipitation	Flooding	Increased sea level could result in scour of bridge foundations.	The Scheme includes a monitoring and management regime which consists of regular general inspections and principal inspections of structures. Refer to the Embedded Mitigation Section for further information.	Medium	Minor adverse	NS
Bridges	Wind	High winds	Storm events and high winds could result in the closure of the bridges for both motorised users, and non-motorised users (pedestrians and cyclists).	The Scheme's design is in line with the latest structural design code (BS EN 1991-1-1-4) which includes consideration for wind loading. Refer to the Embedded Mitigation Section for further information.	Medium	Minor adverse	NS
Bridges	Wind	High winds	Storm events and high winds can lead to damage of bridge asset.	The Scheme includes a monitoring and management regime which consists of regular general inspections and principal inspections of structures.	Medium	Minor adverse	NS
Drainage	Temperature	Low temperatures	drainage pipes freezing and leading to burst, resulting in flooding.	Under future climate scenarios, mean annual and winter mean temperature is increasing and so there is a reduced risk of pipe burst from freezing temperatures. The Scheme includes a monitoring and management regime which consists of regular general inspections and principal inspections of structures. Refer to the Embedded Mitigation Section for further information.	Low	Minor adverse	NS

Receptor	Climate variable	Climate hazard	Potential impacts	Embedded mitigation	Likelihood	Consequence	Significance of effect
Drainage	Precipitation	Flooding Increasing precipitation (winter) Extreme precipitation events	The Scheme is at risk of both tidal and fluvial flooding from the River Dee as well as fluvial flooding from the Queensferry Drain. Tidal flooding from the River Dee is considered the most prominent source of flooding. See the Scheme Flood Consequence Report (Mott MacDonald, 2023) for further information. Flooding can lead to overwhelm of drainage systems and increased acceleration of degradation of assets.	Existing flood defences along the River Dee offers a level of protection to the Scheme. The Scheme includes a comprehensive flood risk and drainage design which is in line with DMRB guidance and has been modelled and designed with consideration of climate change allowances. Measures include new outfall with non-return valve, new flood wall, three pumping stations, new culvert and installation of water level sensors and use of SuDS. The Scheme includes a monitoring and management regime which consists of regular general inspections and principal inspections of structures. Refer to the Embedded Mitigation Section for further information	Medium	Minor adverse	NS
Drainage	Precipitation	Extreme precipitation events Flooding	Surface water flooding following extreme precipitation events may lead to the drainage system becoming overwhelmed. There is also a risk of pipes bursting as a result.	The Scheme includes a comprehensive flood risk and drainage design which is in line with DMRB guidance and has been modelled and designed with consideration of climate change allowances. Measures include new outfall with non-return valve, new flood wall, three pumping stations, new culvert and installation of water level sensors and use of SuDS. The Scheme includes a monitoring and management regime which consists of regular general inspections and principal inspections of structures. Refer to the Embedded Mitigation Section for further information	High	Minor adverse	NS

Receptor	Climate variable	Climate hazard	Potential impacts	Embedded mitigation	Likelihood	Consequence	Significance of effect
Drainage	Precipitation	Decreasing precipitation (summer) Droughts	Decreases in summer precipitation, and drought events, could result in blockages within the drainage system and therefore may require additional maintenance.	The Scheme includes a comprehensive flood risk and drainage design which is in line with DMRB guidance and has been modelled and designed with consideration of climate change allowances. The Scheme includes a monitoring and management regime which consists of regular general inspections and principal inspections of structures. Refer to the Embedded Mitigation Section for further information	Low	Minor adverse	NS
Drainage	Precipitation Wind	Flooding Extreme precipitation events High winds	Drainage and culverts may become blocked from debris during flood events or storms.	The Scheme includes a comprehensive flood risk and drainage design which is in line with DMRB guidance and has been modelled and designed with consideration of climate change allowances. Measures include new culvert with large diameter (1.5 m) and trash screen which reduces risk of blockages. The Scheme includes a monitoring and management regime which consists of regular general inspections and principal inspections of structures. Refer to the Embedded Mitigation Section for further information	Medium	Minor adverse	NS
Drainage	Wind Temperature Precipitation	Extreme temperatures Extreme precipitation events High winds	Loss of power as a result of high winds, extreme temperatures, or precipitation events, may lead to downtime of the pumping station and therefore may increase the risk of flooding.	The associated electrical substations for the pumping stations will have both a fuel tank and generator as back-up in event of loss of power. Refer to the Embedded Mitigation Section for further information	Low	Minor adverse	NS
Earthworks	Temperature Precipitation	Extreme temperatures	Increases in temperature and extreme temperatures alongside a	The Scheme includes a monitoring and management regime which consists of regular general inspections and principal inspections of structures.	Medium	Moderate adverse	NS

Receptor	Climate variable	Climate hazard	Potential impacts	Embedded mitigation	Likelihood	Consequence	Significance of effect
		Increasing temperatures (summer) Droughts Decreasing precipitation (summer)	reduction in precipitation and resulting drought events, particularly during summer months, may result in soil creep and instability of earthwork slopes where soils dry out.	Vegetated slopes within design help to stabilise earthworks. Refer to the Embedded Mitigation Section for further information			
Earthworks	Precipitation	Decreasing precipitation (summer) Droughts	Periods with decreased precipitation could cause soil to shrink and expand, resulting in failure of embankments.	The Scheme includes a monitoring and management regime which consists of regular general inspections and principal inspections of structures. Vegetated slopes within design help to stabilise earthworks. Refer to the Embedded Mitigation Section for further information	Medium	Large adverse	S
Earthworks	Precipitation	Drought followed by high precipitation (summer)	Periods with decreased precipitation followed by high rainfall can lead to soil shrinkage, cracking, and a new route for water to get into slopes causing slope instability and potential for failure.	The Scheme includes a monitoring and management regime which consists of regular general inspections and principal inspections of structures. Vegetated slopes within design help to stabilise earthworks. Refer to the Embedded Mitigation Section for further information	Medium	Large adverse	S
Earthworks	Precipitation	Increasing precipitation (winter) Extreme precipitation events	Ground movements such as earthwork slips may occur where groundwater levels increase as a result of increased precipitation, particularly during winter months, or following extreme precipitation events.	The Scheme includes a comprehensive flood risk and drainage design which is in line with DMRB guidance and has been modelled and designed with consideration of climate change allowances. The Scheme includes a monitoring and management regime which consists of regular general inspections and principal inspections of structures. Refer to the Embedded Mitigation Section for further information.	Medium	Large adverse	S

Receptor	Climate variable	Climate hazard	Potential impacts	Embedded mitigation	Likelihood	Consequence	Significance of effect
Earthworks	Precipitation Sea level rise	Flooding Extreme precipitation events	Increased sea level rise and flows in the River Dee following extreme precipitation events could result in scour of embankments.	The Scheme includes a monitoring and management regime which consists of regular general inspections and principal inspections of structures. Refer to the Embedded Mitigation Section for further information.	Medium	Minor adverse	NS
Earthworks	Wind	High winds	Tree fall and damage to vegetation roots on embankments, contributing to erosion of the embankment where exposed and affecting slope profile providing a source for water to get into the embankment..	The Scheme includes a monitoring and management regime which consists of regular general inspections and principal inspections of structures. Refer to the Embedded Mitigation Section for further information.	Medium	Minor adverse	NS
Highway features (Road pavement)	Temperature	Extreme temperatures Increasing temperatures (summer)	increased risk of surface failure from thermal expansion, cracking, melting and deformation of asphalt.	The design considers the potential use of either WG SMA or HRA asphalt mixes. Both mixes provide resilience to changes in temperature. The Scheme includes a monitoring and management regime which consists of regular general inspections and principal inspections of structures. Refer to the Embedded Mitigation Section for further information.	Medium	Minor adverse	NS
Highway features (Maintenance)	Temperature	Extreme temperatures Increasing temperatures (summer)	There may an inability to perform maintenance activities during periods of high temperatures, particularly during summer .	The Scheme includes a monitoring and management regime which consists of regular general inspections and principal inspections of structures. Refer to the Embedded Mitigation Section for further information.	Medium	Negligible	NS

Receptor	Climate variable	Climate hazard	Potential impacts	Embedded mitigation	Likelihood	Consequence	Significance of effect
Highway features (Road pavement, Pedestrian and cycle routes)	Temperature	Low temperatures	The occurrence of freeze-thaw events will likely be reduced as a result of increasing and/or extreme temperatures. However, the risk may still occur during periods of low temperatures. These freeze-thaw events could lead to erosion, cracking and spalling of highway features.	The Scheme's design is in line with the latest structural design code which includes consideration for temperature. The Scheme includes a monitoring and management regime which consists of regular general inspections and principal inspections of structures. Refer to the Embedded Mitigation Section for further information.	Low	Minor adverse	NS
Highway features (Road pavement, Pedestrian and cycle routes)	Temperature	Low temperatures	The occurrence of snow and ice may decrease with the overall warming trend that is projected; however, periods of cold weather will still occur. During these cold snaps, surfaces may become slippery.	The design considers the potential use of either Stone Mastic Asphalt, or Hot Rolled Asphalt mixes. Both of which have an impermeable nature which help prevent water from penetrating the surface and reducing the risk of ice formation on road surfaces. Refer to the Embedded Mitigation Section for further information.	Low	Negligible	NS
Highway features (Road pavement, Pedestrian and cycle routes)	Precipitation	Increasing precipitation (winter)	Increase in average precipitation may lead to reduced skid resistance of road surface.	The design considers the potential use of either Stone Mastic Asphalt, or Hot Rolled Asphalt mixes Both mixes provide resilience to changes in precipitation and are treated to enhance skid resistance. Refer to the Embedded Mitigation Section for further information.	Low	Minor adverse	NS
Highway features (Road pavement, Other roadside systems, Pedestrian and cycle routes)	Precipitation	Increasing precipitation (winter) Extreme precipitation events	Surface water flooding as a result of increased precipitation and extreme precipitation events, leading to disruption and road closures.	The Scheme includes a comprehensive flood risk and drainage design which is in line with DMRB guidance and has been modelled and designed with consideration of climate change allowances. Measures include new outfall with non-return valve, new flood wall, three pumping stations, new culvert and installation of water level sensors and use of SuDS.	Medium	Minor adverse	NS

Receptor	Climate variable	Climate hazard	Potential impacts	Embedded mitigation	Likelihood	Consequence	Significance of effect
				Shared use paths have been modelled and designed with consideration of climate change. Path levels will be raised between 0.5 m and 1.5 m Refer to the Embedded Mitigation Section for further information.			
Highway features (Roadside foundations)	Precipitation	Increasing precipitation (winter)	Increases in winter precipitation could lead to an increase in sub-surface moisture content, potentially reducing the strength of highway foundations.	The Scheme includes a comprehensive flood risk and drainage design which is in line with DMRB guidance and has been modelled and designed with consideration of climate change allowances. Measures include new outfall with non-return valve, new flood wall, three pumping stations, new culvert and installation of water level sensors and use of SuDS. The Scheme includes a monitoring and management regime which consists of regular general inspections and principal inspections of structures. Refer to the Embedded Mitigation Section for further information.	Low	Minor adverse	NS
Highway features (Road restraint systems e.g. safety barriers, Lighting, Road markings and signs)	Wind	High winds	Damage to safety barriers, lighting, signals and signage may occur during storm events or from high winds.	The Scheme's design is in line with the latest structural design code (BS EN 1991-1-1-4) which includes consideration for wind loading. The Scheme includes a monitoring and management regime which consists of regular general inspections and principal inspections of structures. Refer to the Embedded Mitigation Section for further information.	Medium	Minor adverse	NS
Highway features (Road pavement, Road restraint	Wind Temperature Precipitation	Flooding Extreme precipitation events	Deterioration of highways assets from exposure to climate events	The Scheme includes a monitoring and management regime which consists of regular general inspections and principal inspections of structures.	Medium	Minor adverse	NS

Receptor	Climate variable	Climate hazard	Potential impacts	Embedded mitigation	Likelihood	Consequence	Significance of effect
systems e.g. safety barriers, Lighting, Road markings and signs, Other roadside systems, Pedestrian and cycle routes)		Extreme temperatures High winds	such as high winds, storms, flooding, and high temperatures.	Refer to the Embedded Mitigation Section for further information.			
Landscape and vegetation	Temperature	Extreme temperatures Increasing temperatures (summer)	Increasing and/or extreme temperature events, and reduced precipitation, particularly during summer months may affect vegetation planted as part of the Scheme. Therefore, reduced success in the establishment and survival of landscaping.	Climate change has not been considered within landscape design to date. There has been specification of species at this stage which considers the present-day climate. There is opportunity to consider climate resilient species as part of detailed design.	High	Minor adverse	NS
Landscape and vegetation	Temperature Sea level rise	Extreme temperatures Flooding	The Scheme includes a potential enhancement area of saltmarsh downstream to compensate for the area lost as part of the construction. Current condition is good; however, this is currently being monitored for changes. If the condition declines under current conditions, then there is an opportunity for enhancement. Sea level rise and/or temperature may impact the success of this enhancement feature if it is taken forward.	Climate change has not been considered within the enhancement feature to date. There is opportunity to consider further as part of the detailed design.	Low	Minor adverse	NS
Users: motorised	Precipitation	Increasing precipitation (winter)	Increases in precipitation both annual and in winter months may affect the grip on road surfaces	The Scheme includes a comprehensive flood risk and drainage design which is in line with DMRB guidance and has been modelled and	Low	Negligible	NS

Receptor	Climate variable	Climate hazard	Potential impacts	Embedded mitigation	Likelihood	Consequence	Significance of effect
		Extreme precipitation events	and could potentially result in accidents.	designed with consideration of climate change allowances. Measures include new outfall with non-return valve, new flood wall, three pumping stations, new culvert and installation of water level sensors and use of SuDS. The Scheme includes a monitoring and management regime which consists of regular general inspections and principal inspections of structures. Refer to the Embedded Mitigation Section for further information.			
Users: motorised	Precipitation	Increasing precipitation (winter) Extreme precipitation events	Visibility for motorised travellers may be affected by increased precipitation, potentially resulting in accidents.	Flood warnings provided for the Scheme location. New Flood Emergency Plan will be developed to form part of wider over-arching contingency plan for highway incidents. Refer to the Embedded Mitigation Section for further information.	High	Negligible	NS
Users: motorised	Wind	High winds	High winds may cause tall and exposed motorised vehicles to be turned over, posing a safety risk.	The Scheme's design is in line with the latest structural design code (BS EN 1991-1-1-4) which includes consideration for wind. Refer to the Embedded Mitigation Section for further information.	Medium	Minor adverse	NS
Users: non-motorised	Temperature	Extreme temperatures Increasing temperatures (summer)	Higher temperatures will reduce risk of snow and ice events that cause cycleways and pedestrian pavements to become slippery. However, the risk will still occur.	The Scheme includes a monitoring and management regime which consists of regular general inspections and principal inspections of structures. Refer to the Embedded Mitigation Section for further information.	Low	Minor adverse	NS
Users: non-motorised	Precipitation	Increasing precipitation (winter)	Increases in precipitation could potentially result in diminished	The Scheme includes a comprehensive flood risk and drainage design which is in line with DMRB	Medium	Minor adverse	NS

Receptor	Climate variable	Climate hazard	Potential impacts	Embedded mitigation	Likelihood	Consequence	Significance of effect
		Extreme precipitation events	surface grip on cycleways and pathways and may potentially result in accidents. Actual and perceived safety levels may be affected.	guidance and has been modelled and designed with consideration of climate change allowances. Measures include new outfall with non-return valve, new flood wall, three pumping stations, new culvert and installation of water level sensors. The Scheme includes a monitoring and management regime which consists of regular general inspections and principal inspections of structures. Refer to the Embedded Mitigation Section for further information.			

Table 15-34 Assessment of In-combination Climate Change Impacts

Environmental topic	Climate variable	Potential in-combination climate change impacts	Embedded mitigation	Significance in-combination climate impact?
Geology and soils	Precipitation	Increase in winter precipitation and frequency of extreme rainfall events may lead to impacts on ground conditions and groundwater such as causing contaminants to migrate into the groundwater.	The Scheme includes a comprehensive flood risk and drainage design which is in line with DMRB guidance and has been modelled and designed with consideration of climate change allowances. Measures include new pump station for the new railway underbridge for groundwater levels, groundwater discharge system with filter in place, and a design groundwater level of 4.5 mAOD for the new railway underbridge and 5 mAOD for the River Dee Bridges which includes climate change allowances. Refer to the Embedded Mitigation Section for further information.	Not significant due to the consideration of climate change allowances within the drainage design.
Nature conservation	Precipitation	Increase in winter precipitation and frequency of extreme rainfall events may increase risk of contaminants entering waterbodies and marine environment.	The Scheme includes a comprehensive flood risk and drainage design which is in line with DMRB guidance and has been modelled and designed with consideration of climate change allowances and use of SuDS.	Not significant due to the consideration of climate change allowances and SuDs within the drainage design.

Environmental topic	Climate variable	Potential in-combination climate change impacts	Embedded mitigation	Significance in-combination climate impact?
Landscape and visual effects	Temperature Precipitation	Increase in temperatures throughout the year, particularly in the summer, and severity of extreme heat events as well as drought events may lead to loss of vegetation. This can exacerbate the landscape and visual effect risk, altering the natural scenery and potentially degrading the visual quality of the environment.	There has been specification of proposed planting species at this stage which considers the present-day climate. There is opportunity to consider climate resilient species as part of detailed design.	Not significant due to specification of planting which considers present-day climate.

15.9 Mitigation Measures

Effects on Climate

15.9.1 Recommended mitigation measures for consideration during post-consent detailed design, construction and as part on ongoing reviews and risk management during these Scheme's operation to further enhance resilience are outlined below. For the construction phase, applicable site risks and appropriate weather resilience measures should be reviewed, detailed and included within the production of the CEMP.

a) Implementation of Hazardous Weather Management Plans, which should include but not be limited to the following climate change risks:

b) Storms and extreme events: weather trigger levels (such as amber and red storm warnings) and the response of the local area to extreme events. Should include plans for safe access routes for motorised and non-motorised users.

c) High temperatures: trigger levels to be set, including temperature thresholds and duration of heatwave events, and assessment of the risk to motorised and non-motorised users.

d) Heavy rainfall / flooding: trigger levels of rainfall and response to rainfall events, including management of known areas of surface water ponding and identification of drainage issues.

Structural and highways design

Extreme temperatures

a) Research the use of materials with higher thermal tolerance for joints and bearings.

b) Integrate passive or active cooling systems.

Low temperatures

c) Apply anti-freeze coatings to vulnerable areas.

d) Consider use of thermal insulation materials to protect critical components.

Increasing precipitation

e) Enhancing waterproofing by research and using new materials and techniques where they exist.

Decreasing precipitation

f) Plant drought-resistant vegetation to stabilise soil.

Sea level rise

g) Implement scour protection measures such as riprap or concrete aprons.

h) Reinforce foundations to withstand increased water flows.

Flood risk and drainage design

Increasing precipitation

a) Install temporary or permanent flood barriers.

b) Raise the elevation of shared use paths to further prevent flooding.

c) Enhance sub-surface drainage systems to manage moisture levels.

Extreme precipitation events

d) Develop emergency drainage plans to manage overflow.

Decreasing precipitation

e) Consider the implementation of filtration systems to prevent blockages.

Maintenance and management

Extreme temperatures (summer)

a) Adjust maintenance periods to cooler periods (early morning or late evening)

b) Provide workers with cooling vests and hydration stations.

Decreasing precipitation

c) Increase the frequency of drainage system clearing.

d) Use sensors to detect and address blockages promptly.

Extreme precipitation events

e) Reinforce pipes to withstand high pressure.

15.10 Monitoring

Effects on Climate

15.10.1 Following best practice, it is advised that a post-construction carbon assessment is undertaken to account for the ‘as-built’ values in materials

used and construction processes undertaken. The purpose of this is to track the progress of carbon reductions, as well as to understand what is needed in managing whole life carbon of the Scheme. Figures provided in this ES chapter are estimations and are expected to change as the level of detail improves throughout the Scheme Lifecyle.

15.10.2 A CMP has been produced to integrate carbon management within the project. This is a live document which is updated as the scheme progresses through the design, to encourage the consideration of carbon reduction through all phases of the scheme. It outlines the PAS 2080 recommended carbon management process, and the methodology used for conducting the carbon assessments. This document will be passed on to the Principal Contactor for consideration within the subsequent stages of the Scheme.

Vulnerability of the Scheme to Climate Change

15.10.3 During the operation phase, there are a variety of measures, sometimes referred to as secondary measures, which include monitoring (including both remote and visual inspection) and management strategies, to ensure continuing effective operation and resilience throughout the operational lifetime. Recommendations for secondary measures with the potential to be considered for this scheme are presented in Section 15.9.

15.10.4 Monitoring of extreme weather events such as flooding and extreme heat, and their operational impacts, as well as periodic and proactive inspection and maintenance regimes can also provide insights into key vulnerabilities of existing and new assets and can be helpful in decision-making for future resilience-building measures. Planned maintenance should also include climate change allowances such as increased chronic deterioration due to harsher climatic conditions.

15.11 Conclusion

Effects on Climate

15.11.1 The construction and operation phases of the Scheme which fall within legislated carbon budget periods are expected to have a *not significant* impact on the ability of the UK and Welsh Governments. The Scheme is estimated to result in less than 0.0001% than any of the Welsh or UK Government carbon budgets.

15.11.2 The Scheme demonstrates strong alignment with Welsh and UK transport and carbon policy, including the *Environment (Wales) Act 2016*, *Net Zero Wales*, and the *National Transport Delivery Plan 2022–2027*. The Scheme has incorporated a range of embedded carbon reduction measures to minimise emissions throughout its lifecycle and to not increase road capacity. While an increase in emissions is anticipated due to construction, land use change, and operational emissions, overall whole life carbon emissions are not significant enough to affect net zero objectives.

15.11.3 Key control measures include the implementation of a 50mph speed limit to reduce both construction and operational emissions, the development of a Carbon Management Plan in line with PAS 2080, and the use of a Carbon Opportunities Register to identify and act on further reduction opportunities. The selection of a single bridge design over a dual option, the elimination of carbon-intensive cofferdam structures, and the adoption of the least disruptive construction methodology to traffic flows further demonstrate the Scheme's commitment to low-carbon delivery. With these measures, alongside enhancements to active travel infrastructure that support modal shift, the Scheme aims to contributes to national decarbonisation objectives.

15.11.4 Recognising the importance of impacts on climate change, the Scheme shall continue to seek to reduce GHG emissions as far as practicable. It is anticipated that a further as-built carbon assessment, including GHGs, should be undertaken post-construction as to report progress against carbon reduction.

Vulnerability of the Scheme to Climate Change

The vulnerability of the Scheme to climate change is anticipated to be Not Significant. While there is potential for climate change to adversely affect the Scheme throughout its operational lifetime, the embedded mitigation measures within the Scheme's design will reduce the significance rating of potential climate impacts.

Llywodraeth Cymru / Welsh Government

A494 RIVER DEE BRIDGE REPLACEMENT SCHEME

Environmental Statement

Volume 1: Technical Assessment Report

Chapter 16: Marine Environment

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16. Marine Environment

16.1 Introduction

16.1.1 This Marine Environment chapter provides an assessment of likely significant effects on receptors identified as being at risk from the impacts of construction, operation and maintenance associated with the proposed A494 River Dee Bridge replacement scheme (hereafter referred to as 'the Scheme').

16.1.2 For further information on the Scheme, please refer to Chapter 2: The Project and the outline CEMP (Appendix 18A). For detailed construction information, refer to the Constructability Report and Construction Programme (Doc ref: 395318-MMD-00-XX-RP-Z-0034).

16.1.3 There are several potential effect pathways which are relevant and are considered within this chapter. These include, but are not limited to, the following:

a) Pre-construction activities – ground investigations, site preparation.

b) Construction phase – construction and demolition, noise and vibration, temporary lighting, habitat loss from land take, pollution incidents and sediment disturbance.

c) Operational phase – permanent habitat loss, change in hydrology, permanent lighting, road run-off, alteration to hydrodynamics.

16.1.4 For the purposes of this chapter, 'biodiversity' and 'ecology' relate to the marine environmental features, namely designations, habitats, and species, within the defined scheme area. The information presented in this chapter identifies and assesses marine environmental features using baseline data gathered from both desk-based searches and site surveys. It also defines the likely 'Zone of Influence' (ZoI) for the proposed works, based on construction information available to date and outlines the basis for scoping in the assessment of marine biodiversity. Please refer to Chapter 8 (Terrestrial Biodiversity) for an assessment of the terrestrial ecology receptors.

16.1.5 An assessment of the likely significant effects (LSE) resulting from construction, operation and maintenance of the Scheme is included for each marine ecological receptor (within the categories of protected designations, areas, and

species). Based on these effects, avoidance and mitigation measures to prevent, reduce, or offset any adverse effects are described. Following this, the effects are reassessed for each receptor and the Scheme as a whole, considering all primary, secondary, and tertiary mitigation to then determine any residual effects.

16.1.6 Other chapters of the environmental statement (ES) which cover impacts that are related to the marine environment are:

a) Chapter 7: Road Drainage and the Water environment
b) Chapter 8: Terrestrial Biodiversity
c) Chapter 12: Noise and Vibration
d) Chapter 15: Climate Change & Greenhouse Gases

16.2 Legislation and Policy Framework

16.2.1 This assessment has been undertaken in accordance with relevant legislation, having regard to national and local plans and policies.

16.2.2 The principal legislative and planning context in relation to the assessment of the environmental effects of the Scheme on the marine environment is summarised below.

National legislation and planning policy of Wales

16.2.3 This chapter has been prepared with reference to the following UK nature conversation legislation and key national policies, which influence the marine environment assessments:

National Legislation

a) The Conservation of Habitats and Species (Amendment) (EU Exit) Regulations 2019[1]

[1] European Commission (1979) Council Directive on the Quality Required of Shellfish Waters. Available at: eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:31979L0923

b) The Wildlife and Countryside Act (WCA) 1981[2]

c) The Marine and Coastal Access Act 2009[3]

d) The Natural Environment and Rural Communities (NERC) Act 2006[4]

e) Environment Act 2021[5]

f) Environment (Wales) Act 2016[6]

g) The Water Environment (Water Framework Directive (WFD)) (England and Wales) Regulations 2003 (amended)[7]

h) The Wellbeing of Future Generations (Wales) Act 2015[8]

i) UK Government cross-border byelaws to protect Atlantic salmon[9] and sea trout[10]

National Policies

a) The Marine Policy Statement 2011[11]

b) National Planning Policy Framework (NPPF) 2012 and revised 2021[12]

c) 2024 UK Biodiversity Framework[13] (superseding the UK Post-2010 Biodiversity Framework 2012)[14]

16.2.4 In particular, under the Environment (Wales) Act 2016, public bodies, including Local Authorities, have a statutory duty "*to seek to maintain and enhance biodiversity in Wales*" when carrying out their normal functions. Under the

[2] UK Government (1981) Wildlife and Countryside Act 1981. Available at: Wildlife and Countryside Act 1981
[3] UK Government (2009) Marine and Coastal Access Act 2009. Available at: Marine and Coastal Access Act 2009
[4] UK Government (2006) Natural Environment and Rural Communities Act 2006. Available at: Natural Environment and Rural Communities Act 2006
[5] UK Government (2021) Environment Act 2021. Available at: Environment Act 2021
[6] Welsh Government (2016) Environment (Wales) Act 2016. Available at: Environment (Wales) Act 2016
[7] UK Government (2017) The Water Environment (Water Framework Directive) (England and Wales) Regulations 2017. Available at: The Water Environment (Water Framework Directive) (England and Wales) Regulations 2017
[8] Welsh Government (2016) The Well-being of Future Generations (Wales) Act 2015. Available at: Well-being of Future Generations (Wales) Act 2015 | Law Wales
[9] Natural Resources Wales. Salmon open seasons and method restrictions. Available at: Natural Resources Wales / Salmon open seasons and method restrictions
[10] Natural Resources Wales. Sea trout open seasons and method restrictions. Available at: Natural Resources Wales / Sea trout open seasons and method restrictions
[11] Defra (2011) UK Marine Policy Statement. Available at: UK marine policy statement - GOV.UK
[12] UK Government (2012) National Planning Policy Framework. Available at: National Planning Policy Framework - GOV.UK
[13] JNCC (2024) UK Biodiversity Framework
[14] JNCC (2012) UK Post-2010 Biodiversity Framework (2012-2019). Available at: UK Post-2010 Biodiversity Framework (2012–2019) | JNCC Resource Hub

Section 7a list of species and habitats of principal importance to the conservation of biodiversity in Wales (also known as ‘priority’ or ‘Section 7’ species and habitats) was drawn up and acts as an aid to guide public bodies in implementing their duty. The Local Authority must consider the impact of the proposed works on these Section 7 habitats and species.

16.2.5 Consideration of the legal protection of designated sites, habitats and species under the above context has informed the assessment of scale and ‘importance’ of each receptor (in line with relevant guidance), as well as the assessment and mitigation requirement; with the aim to:

a) Promote the conservation of landscape and biodiversity, in particular the conservation of native wildlife and habitats;

b) Ensure that action in Wales contributes to meeting international responsibilities and obligations for the natural environment;

c) Ensure that statutory designated sites are properly protected and managed;

d) Safeguard protected species; and

e) Promote the functions and benefits of soils/sediments, and in particular their function as a carbon store.

16.2.6 The Conservation of Habitats and Species Regulations 2017 (as amended) ensures the protection of Special Areas of Conservation (SACs) and Special Protection Areas (SPAs) in the UK, which no longer form part of the EU’s Natura 2000 ecological network. The amended Regulations have created a National Site Network (NSN) on land and at sea, including both the inshore and offshore marine areas in the UK. The NSN includes existing SACs and SPAs, new SACs and SPAs are designated under these Regulations.

16.2.7 A network of nationally designated sites has been established through the designation of Sites of Special Scientific Interest (SSSIs) under the Wildlife and Countryside Act 1981 (as amended). The protection given under the Act means it is an offence to carry out or permit to be carried out any operation listed within the notification without the consent of the Statutory Nature Conservation Organisation (SNCO). The protection for SSSIs is used to underpin the designation of areas within the NSN. The Welsh Government has

responsibilities with respect to SSSIs under Section 28G of the Wildlife and Countryside Act 1981.

16.2.8 All wild birds, their nests and eggs are protected under Part 1, Section 1 of the Wildlife and Countryside Act. Birds listed in Schedule 1 of the Act are subject to special protection. Wild animals listed in Schedule 5 are protected under Section 9. Plants listed in Schedule 8 are protected under Section 13 of the Act. For this chapter, the protection of waterbirds and waders and intertidal plant habitats (i.e. saltmarsh) are relevant and considered.

16.2.9 The Wildlife and Countryside Act also includes provisions for the control of invasive non-native species (INNS). Under these provisions it is an offence to:

a) Release, or allow to escape into the wild, any animal which is not ordinarily resident in, or a regular visitor to, Great Britain or is included in Schedule 9 of the Act.

b) Plant, or otherwise cause to grow in the wild, any plant which is included in Schedule 9 of the Act.

16.2.10 The Environment (Wales) Act 2016 introduces a new, enhanced Biodiversity and Resilience of Ecosystem Duty on public bodies to ensure that biodiversity is an integral part of decision making. Public authorities will be required to report on the actions they are taking to improve biodiversity and promote ecosystem resilience.

Planning Policy Wales

16.2.11 The Welsh Government published Planning Policy Wales (PPW) Edition 12 in February 2024. It states that the main planning principles for coastal places, which reflect the principles of Integrated Coastal Zone Management, are to support urban and rural development, while at the same time being aware of, and appropriately responsive to, the challenges resulting from the dynamic interaction of natural and development pressures in coastal areas[15].

[15] Welsh Government (2024) Planning Policy Wales (Edition 12)

Technical Advice Note 5: Nature Conservation and Planning

16.2.12 The PPW is supplemented by 21 topic-based Technical Advice Notes (TAN). In particular TAN 5 – Nature Conservation and Planning[16] provides advice about how the land use planning system should underwrite the protection and enhancement of biodiversity and geological conservation.

UK Biodiversity Frameworks 2024

16.2.13 As a result of new drivers and requirements, the 'UK Biodiversity Framework', published in July 2012, has succeeded the UK Biodiversity Action Plan (BAP). Particularly, due to devolution and the creation of country-level biodiversity strategies, much of the work previously carried out under the UK BAP is now focused at a country level. The UK BAP lists of priority species and habitats remain; however, important and valuable reference sources. Notably, they have been used to help draw up statutory lists of priority species and habitats in Wales under The Environment (Wales) Act 2016[17].

16.2.14 The Environment (Wales) Act 2016 aims to build greater resilience for ecosystems. The Wales Biodiversity Partnership (WBP)[18] supports the Act and stating that '*Biodiversity and well-functioning ecosystems provide natural solutions that build resilience, which in turn help society create jobs, support livelihoods and human well-being, adapt to the adverse impacts of climate change and contribute to sustainable development*'.

Local Planning Policy

Flintshire Local Development Plan

16.2.15 At a local level, planning policies are set out within the Flintshire Local Development Plan[19] (adopted in January 2023).

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[16] Welsh Government (2009). Planning Policy Wales - Technical Advice Note 5: Nature Conservation and Planning. [online]. Available at: Technical advice note (TAN) 5: nature conservation and planning | GOV.WALES
[17] https://www.biodiversitywales.org.uk/Environment-Wales-Act
[18] Home - Wales Biodiversity Partnership
[19] Flintshire Local Development Plan

16.2.16 The following policies are considered relevant to this chapter:

a) Policy STR13: Natural and Built Environment, Green Networks and Infrastructure;

b) Policy STR14: Climate Change and Environmental Protection;

c) Policy EN2: Green Infrastructure;

d) Policy EN3: Undeveloped Coast and Dee Estuary Corridor; and

e) Policy EN6: Sites of Biodiversity Importance.

16.2.17 Policy STR13 states:

"Development should identify, respect, protect, enhance and connect Flintshire's environmental assets, to create a multifunctional network of natural and historic resources. Development should:

i. Protect open countryside and the undeveloped coastline;

ii. Protect the open character and appearance of green wedges;

iii. Conserve, protect and enhance the quality and diversity of Flintshire's natural environment including landscape, biodiversity, the Dee Estuary and the Clwydian Range and Dee Valley National Landscape (formerly known as an AONB);

iv. Promote opportunities to enhance biodiversity and ensure resilience;

v. Maintain, enhance and contribute to green infrastructure;

vi. Create and protect green spaces and open space / play environments that encourage and support good health, well-being and equality;

vii. Conserve, protect and enhance the local distinctiveness and quality of Flintshire's built and historic environment including listed buildings, conservation areas, registered historic parks, gardens and landscapes, scheduled ancient monuments and other locally important historic assets;

viii. Make financial contributions where appropriate, to facilitate and maintain the favourable conservation status of key environmental assets;

ix. Support measures to minimise the consequences of climate change;

x. Protect playing fields and open space from development; and

xi. Ensure adequate new open space and playing fields are provided as part of new housing development."

16.2.18 Policy STR14 states:

"The Council will seek to mitigate the effects of climate change and ensure appropriate environmental protection in the County through:

i. Ensuring new development is sustainably located and designed so as to reduce the need for travel by private car;

ii. Encouraging the use and development of appropriate or suitable brownfield land;

iii. Adopting a sustainable approach to water resource management including supply, surface water run-off and waste water treatment;

iv. Directing development away from flood risk areas, assessing the implications of development in areas at risk of flooding and ensuring that new development does not increase the risk of flooding elsewhere;

v. Encouraging energy efficient development, environmentally acceptable renewable and zero / low carbon energy generation and combined heat and power and communal / district heating networks;

vi. Ensuring that new development has regard to the protection of the environment in terms of air, noise and light pollution, unstable and contaminated land and former landfill sites;

vii. Designing development to be adaptable and resilient to future effects of climate change."

16.2.19 Policy EN2 states:

"Development proposals will be required to protect, maintain and enhance the extent, quality and connectivity of the green infrastructure network, including designated and non-designated green spaces (as shown on the proposals maps and listed in the table below), and where appropriate:

a. create new green infrastructure linkages from the proposed development to the existing local network;

b. fill in gaps in the existing network to improve connectivity.

Where the loss or damage of existing green infrastructure is unavoidable, appropriate mitigation and compensation will be required."

16.2.20 Policy EN3 states:

"Within the undeveloped coast development will only be permitted where:

a. it can be demonstrated a coastal location is essential;

b. it conserves and enhances the open character of the coast;

c. it would not unacceptably harm areas of nature conservation, landscape or biodiversity;

d. it would not harm existing or proposed recreational or active travel routes;

e. extensive coastal protection measures are not required; and

f. it would not be potentially at risk of flooding nor unacceptably increase erosion or flooding or interfere with natural coastal processes."

16.2.21 Policy EN6 states:

"Development will not be permitted that would result in an adverse effect on the integrity of sites of international nature conservation importance. Proposals where adverse effects on site integrity cannot be ruled out would not be supported.

Development likely to impact the special features of a Nationally Designated Site will only be granted in exceptional circumstances where appropriate compensation can be provided.

Development proposals that would have a significant adverse effect on locally designated sites or site with other biodiversity and / or geological interest, including priority species, will only be permitted where:

a. *it can be demonstrated that the need for the development outweighs the biodiversity or geological importance of the site; and*

b. *it can be demonstrated that the development cannot reasonably be located elsewhere; and c. any unavoidable harm is minimised by effective mitigation to ensure that there is no reduction in the overall biodiversity value of the area. Where this is not feasible compensation measures designed to create, restore and enhance biodiversity must be provided.*

Development that results in the restoration, enhancement and creation of habitats will be supported especially where this promotes the resilience of ecosystems."

Shoreline Management Plan

16.2.22 The relevant Shoreline Management Plan (SMP) for the Scheme is the North West England and North Wales Coastal Group Shoreline Management Plan (SMP 22 –Great Ormes Head to Solway Firth, 11a 5.3)[20]. The policy rationale states to "*maintain existing defences into the long term. Potential for a secondary set-back defence to be built for flood storage or habitat creation, depending on outcome of further studies*".

[20] North Wales Coastal Group (2023). Shoreline management. Available at: Shoreline Management Plans – North West Coastal Group

Flintshire County Council Environment Act – Section 6 Biodiversity Duty Delivery Plan (update 2020)[21]

16.2.23 A document which outlines how Flintshire County plan to maintain and enhance biodiversity under the Environment (Wales) Act 2016. Objectives comprise:

a) Objective 1: Engage and support participation and understanding to embed biodiversity throughout decision making at all levels;

b) Objective 2: Safeguard species and habitats of principle importance and improve their management;

c) Objective 3: Increase the resilience of our natural environment by restoring degraded habitats and habitat creation;

d) Objective 4: Tackle key pressures on species and habitats;

e) Objective 5: Improve our evidence, understanding and monitoring; and

f) Objective 6: Put in place a framework of governance and support for delivery.

Nature Recovery Plan for Coastal and Marine Habitats in North East Wales[22]

16.2.24 The Nature Recovery Action Plan outlines targets for short-term (up to 12 months), medium-term (1 to 5 years), and long-term (5+ years) for nature conservation in North East Wales, focusing on four broad habitat types; Woodland, Wetland, Grassland, and Coastal/Marine.

[21] Flintshire County Council, 2020. Biodiversity Duty Delivery Plan. Available at: Flintshire County Council Environment Act - Section 6 Biodiversity Duty Delivery Plan (update 2020)
[22] Bionet Wales, 2025. Coastal and Marine Nature Recovery Action Plan. Available at: Coastal and Marine - Bionet

Technical guidelines

16.2.25 Ecological assessments were undertaken in compliance with the following relevant guidance and best practice:

a) Chartered Institute of Ecology and Environmental Management (CIEEM) (2022) Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater, Coastal and Marine (Version 1.3)[23]

b) Joint Nature Conservation Committee (JNCC) (2022) The Marine Habitat Classification for Britain and Ireland (Version 22.04)[24]

c) Natural Resources Wales (NRW) Marine Licensing: Environmental Impact Assessment for Marine Activities Guidance[25]

16.3 Consultation

16.3.1 A summary of the consultation responses from stakeholders or consultees in relation to the proposed scope of the Marine Environment assessment, plus subsequent correspondence since the EIA Scoping report, is set out in Table 16-1 below.

Table 16-1 Consultation responses associated with the Marine Environment

Date	Consultee	Issues Raised	How has this been Addressed?
26th May 2022	Environmental Liaison Group (ELG) Meeting (NMWTRA, Welsh Government, SMW, NRW, Flintshire CC, CPAT, ECAT, RML, MM)	Agreed that the Greenfield site is an additional area for saltmarsh enhancement and was a positive measure to that could be attributable to the Scheme. Any enhancements which is not mitigation for loss/damage of saltmarsh as a result of the Scheme is a positive measure.	Noted in this report as a habitat enhancement area for the Scheme, as well enhancing the shaded area below the existing River Dee bridge (once bridge deck is removed) to replace the area of saltmarsh habitat expected to deteriorate due to shading of the replacement bridge.

[23] CIEEM (2022) Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater, Coastal and Marine, Version 1.3 – Updated September 2024. Available at: Guidelines for Ecological Impact Assessment (EcIA) | CIEEM
[24] JNCC (2022) The Marine Habitat Classification for Britain and Ireland Version 22.04. Available at: JNCC Marine Habitat Classification
[25] Natural Resources Wales / Environmental Impact Assessment for marine activities

Date	Consultee	Issues Raised	How has this been Addressed?
31st January 2025	Natural Resources Wales (NRW) – EIA Scoping Opinion	Recommend adding a list of works that are deemed to require a Marine Licence.	Permits and licences consents tracker is in progress and will be completed for the Draft Order application.
31st January 2025	Natural Resources Wales (NRW) – EIA Scoping Opinion	Given location and scale of development a report to inform Habitats Regulations Assessment (HRA) will be required and should be included in the EIA.	As well as the EIA process to assess the potential environmental impacts of the Scheme, a separate HRA screening and appropriate assessment report has been prepared (Doc Ref: 395318-RML-00-XX-RP-L-0006).
31st January 2025	Natural Resources Wales (NRW) – EIA Scoping Opinion	Advise that the assessment of impact to other receptors (e.g. benthic ecology, water quality, fish) caused by the generation of SSC plumes during the construction phase (e.g. piling for bridge supports, dredging at the ALOF [Airbus Loading Operations Function], disturbance of the riverbank caused by plant activity) needs to use the maximum spring tide excursion of the tidal River Dee, to define the spatial extent of impact upstream and downstream of the proposed works.	See Section 16.9 of this Chapter – Assessment of Construction Activities, which assesses the impact on designated sites, fish, marine invertebrates and waterbirds. Water quality has been addressed in Chapter 7 (Water Environment). Note: assessment of ALOF has been removed as this is no longer part of the Scheme.
31st January 2025	Natural Resources Wales (NRW) – EIA Scoping Opinion	Fisheries - NRW indicated agreement with the sites and features scoped in for further assessment, i.e. Migratory fish features of the river Dee and Bala Lake and Dee Estuary Special Area of Conservation (SACs). However, we advise that European smelt (*Osmerus eperlanus*) is a feature of both the river Dee and Dee estuary Site of Special Scientific Interest	European smelt has been included in Section 16.6 (Baseline) and assessments of land take, construction and operation (Sections 16.8, 16.9, and 16.10, respectively).

Date	Consultee	Issues Raised	How has this been Addressed?
		(SSSI) and should be included in the assessment.	
31st January 2025	Natural Resources Wales (NRW) – EIA Scoping Opinion	NRW indicated disagreement with the statement that all the protected species do not feed on the journey up the estuary. European eels will likely feed and be resident in the channelised section. In addition, river lamprey primarily reside in estuaries feeding on estuarine fish, such as herring and flatfish (Maitland 2003).	This has been addressed and added to the Section 16.6 - Baseline Conditions.
31st January 2025	Natural Resources Wales (NRW) – EIA Scoping Opinion	Indirect impacts on marine Dee Estuary SAC features should be included in the assessment in relation to piling/dredging activities of the bridge construction, as well and decommissioning of the existing bridge. Although the proposed site is outside of the Dee Estuary SAC (approx. 1km upstream) there is potential for secondary impacts on the SAC features i.e. intertidal mudflats and sandflats and Estuaries features, from sedimentation and/or release of contaminants from piling and dredging activities. Although these impacts will likely be temporary, full details should be included as part of the ES. Inclusion of marine biosecurity to minimise the risk of introduction and spread of marine invasive non-native species (INNS).	See Section 16.9 – Assessment of Construction Activities, which assesses the impact on designated sites, fish, marine invertebrates and waterbirds. Biosecurity/INNS is covered in Section 16.7 (Mitigation). Note: Dredging is no longer part of the construction methodology so has been removed from the assessment.
31st January 2025	Natural Resources Wales (NRW) – EIA Scoping Opinion	Further assessment should be provided to understand if the works have the potential to displace or disturb overwintering	Waterbirds and waders have been added into Section 16.6 - Baseline Conditions and are part of the assessments of land take,

Date	Consultee	Issues Raised	How has this been Addressed?
		and passage bird features of the Dee Estuary SPA, RAMSAR and SSSI. If the construction works are undertaken outside of the months of August to March inclusive, there will be no impact pathway to the overwintering and passage bird features of the Dee Estuary SPA, RAMSAR and SSSI.	construction and operational activities.
8th April 2025	Natural Resources Wales (NRW) Fisheries team – EIA Scoping Response	Demolition works: The proposed demolition of the existing road bridge should be included in the Environmental Statement (ES) under the 'Rochdale' envelope principle to ensure a realistic worst-case scenario is considered. Furthermore, we advise that for the full ES, further details and assessment of in-river works, demolition and removal of the existing river piles is required, and that timing restrictions to protect migratory fish may be necessary for works, such as use of breakers and diamond saw wires. Piling methods: New foundation piles constructed using rotary bored piles followed by oscillation/vibration piling. NRW welcomes this and advises that as no percussion piling will be used, the proposed timing restrictions detailed under 'Mitigation' on page 7 (EIA Scoping report) to reduce disturbance to migratory fish are acceptable. However, should percussive piling be deemed	Noted and addressed in this report and the HRA screening and appropriate assessment (Doc Ref: 395318-RML-00-XX-RP-L-0006).

Date	Consultee	Issues Raised	How has this been Addressed?
		necessary, this will require further consultation with NRW and assessment in the ES, including underwater noise modelling. Temporary sheet piling: The need to install temporary sheet piles on the northeastern riverbank is noted; however, it is not clear whether these will be installed within the 'wet' (at high water) river channel, if the site is outside the river, or whether installation will only occur at low ride. If installed in the river channel using non-percussive piling methods, the timing restrictions mentioned above should be applied. If percussive piling is needed then consultation with NRW would be required, alongside a full assessment in the ES, potentially including underwater noise modelling (Volume 3; Appendix 16.C).	

16.4 Assessment Methodology

16.4.1 Please refer to Chapter 4 (Approach to EIA) of this Environmental Statement for the general methodology to the EIA. Chapter 4 sets out the overall approach to the assessment of the likely effects of the Scheme and includes details of the overall legislative framework and consultation undertaken.

Gathering of baseline information

Study Area

16.4.2 For the purposes of this assessment, the Study Area used has been defined with reference to the Red Line Boundary (RLB) of the Scheme (also referred to as 'the Scheme Boundary'), outlined in Chapter 2 (The Project).

River characteristics and terminology

16.4.3 The Scheme is found on the canalised section of the River Dee. This River originates in Snowdonia, Wales and flows through North Wales and Cheshire, England, before entering the Dee Estuary. The River Dee SSSI and the River Dee & Bala Lake SAC extends through the entire river from its source, downstream just beyond the Flintshire/A548 Bridge to the start of the Dee Estuary Ramsar, SAC and SPA (National Grid Reference (NGR): SJ 28906 71135). The River Dee is tidally influenced up to the Chester Weir fish trap (NGR: SJ 40797 65841).

16.4.4 The Dee Estuary is a large, sheltered estuary, which flows from the River Dee into Liverpool Bay. The Dee Estuary is a designated Ramsar site, SAC and SPA and extends from the mouth of the Estuary by Talacre upstream on the southwestern bank, just past Harwarden railway bridge (NGR: SJ 31415 69115).

16.4.5 For the purposes of this chapter, the use of the River Dee and Dee Estuary will follow the extents of the abovementioned designations.

Zone of Influence (ZoI)

16.4.6 The CIEEM guidance (Version 1.3)[26] on ecological assessments recommends that all ecological features that occur within a ZoI for a proposed development are considered; therefore, the ZoI for the Scheme is the area in which desktop searches are undertaken to ensure that all potential ecological features are considered in the determination of potential effects. The ZoI includes:

a) Areas directly within the land take for the proposed development and access;

b) Areas that will be temporarily affected during construction;

c) Areas likely to be impacted by hydrological disruption (hydrologically connected); and

d) Areas where there is a risk of pollution and noise disturbance during construction and / or operation.

16.4.7 The ZoI is normally variable, depending on the ecological features concerned and the construction activities planned. For this assessment, the ZoI is outlined in Table 16-2 Note: this chapter covers marine and coastal designations, for terrestrial and freshwater ecological designations, please refer to Chapter 8 (terrestrial biodiversity).

Table 16-2 Zone of Influence for this assessment

Site	ZoI	Justification
Non-statutory designated sites	1km	Based upon the information currently available for the intended works, this reflects a precautious distance within which designated sites and qualifying features associated with non-statutory designated sites may be affected.
Statutory designated sites	2km	Based upon the information currently available for the intended works, this reflects a precautious distance within which designated features may be affected. This is in line with requirements for assessment of impacts against water framework directive[27]

[26] https://cieem.net/wp-content/uploads/2018/08/EcIA-Guidelines-v1.3-Sept-2024.pdf
[27] Environment Agency (2017) Water Framework Directive assessment: estuarine and coastal waters. Available at: Water Framework Directive assessment: estuarine and coastal waters - GOV.UK

Site	ZoI	Justification
Hydrologically connected statutory designated sites	12km	If any harmful substances were to enter the water, this distance covers the potential maximum dispersion. This is based on twice the length of the closest tidal excursion (with a maximum of 12km downstream/ upstream from site, due to lower tidal influence) [28].

Desk study

16.4.8 A baseline desktop study was undertaken to describe the marine environment of the study area and is presented in Section 16.6 - Baseline Conditions.

Field surveys

16.4.9 Field surveys undertaken to inform this chapter are the intertidal walkover surveys, wintering and breeding bird surveys (waterbirds and waders assessed in this chapter).

16.4.10 Intertidal walkover surveys were undertaken in March and July 2025 by suitably qualified marine ecologists from Mott MacDonald, using the following best practice guidance:

a) Joint Nature Conservation Committee (JNCC) Marine Monitoring Handbook[29]; and

b) The JNCC Handbook for Phase 1 Habitat Survey, a Technique for Environmental Audit[30].

16.4.11 Marine habitat codes adopted from the Marine Habitat Classification for Britain and Ireland[31] are used to describe the biotopes observed during the survey, and the SACFOR[32] abundance scale utilised to record the cover/density of

[28] ABPmer. UK Renewables Atlas. Available at: Explore the ABPmer UK Renewables Atlas
[29] Davies et al., 2001. Marine Monitoring Handbook. Available at: data.jncc.gov.uk/data/ed51e7cc-3ef2-4d4f-bd3c-3d82ba87ad95/mmh-PG4-5.pdf
[30] JNCC, 2010. Handbook for Phase 1 habitat survey – a technique for environmental audit. Available at: Handbook for Phase 1 habitat survey
[31] JNCC, 2010. Marine Habitat Classification for Britain and Ireland. Available at: JNCC Marine Habitat Classification
[32] Super-abundant, Abundant, Common, Frequent, Occasional, Rare, Present

species identified[33]. The survey commenced two hours before the low tide with the lower littoral zone surveyed at the low tide (see Table 16-3 for tide times).

Table 16-3 Tide times and heights (source: Source: WillyWeather[34])

Date	Location	Low water	Height above chart datum (m)
13/03/2025	A494 River Dee Bridge	9.18am	0m
25/03/2025	Greenfield site, Flint	3.21pm	2.72m

16.4.12 Full methodologies and details are provided in the intertidal survey report (Appendix 16A, Volume 3; Document Reference: 395318-RML-00-XX-RP-L-0014) and breeding and wintering bird survey reports (Appendix 8B, Volume 3), appended to the ES.

16.4.13 The normal validity period for ecology surveys is 1 - 2 years dependent upon the species or habitat being surveyed[35]. Surveys completed during this study may require further updating or revalidation as the Scheme progresses. A summary of surveys undertaken for the Scheme is provided in Table 16-4

Table 16-4 Summary of surveys 2018 – 2025

Survey type	Date survey completed	Survey details	Summary of findings
NVC Saltmarsh and intertidal walkover surveys	2021 and July 2022 updated 27th June 2024 for proposed mitigation areas only. March 2025 – intertidal walkover surveys 7th July 2025 – NVC surveys, full Scheme area.	Surveys to inform potential mitigation areas Wepre and Greenfield and baseline of the Scheme area.	The intertidal area of the Scheme site was characterised by mud and sandy mud habitats consistent with an upper estuarine environment. The Wepre saltmarsh site shows signs of succession along the seaward bund with an increase in scrub, tall ruderal and grass

[33] JNCC, 1990. SACFOR abundance scale used for both littoral and sublittoral taxa from 1990 onwards. Available at: sacfor.pdf
[34] River Dee - Queensferry New Bridge Tide Times, Flintshire - WillyWeather
[35] CIEEM (April 2019) Advice Note on the Lifespan of Ecological Reports and Surveys. Available at https://cieem.net/wp-content/uploads/2019/04/Advice-Note.pdf [Accessed 21/01/25]

Survey type	Date survey completed	Survey details	Summary of findings
			species not specific to saltmarsh communities. The Greenfield saltmarsh site presents as a miniature salt-marsh tidal creek ecosystem. Saltmarsh reports are provided separately in Appendix 16B.
Wintering bird surveys	Nov 2018 and Feb 2019 (inclusive). Nov 2020 – Feb 2021 November 2022 to January 2023 Nov 2023 – Feb 2024 September 2024 to March 2025	Low tide counts and wintering bird surveys conducted once a month.	Notable bird species recorded including Schedule 1, birds of Principle Importance in Wales and Red List Birds of Conservation Concern. The Dee Estuary Ramsar/SPA sites supports internationally important populations of several species. Surveys conducted to date have identified wintering SPA species utilising the fields and the riverbanks within the site extent.
Breeding Bird Surveys	1 April to 31 July 2021 April – July 2023 April – July 2025	The survey methodology applied for the breeding bird surveys broadly followed that used for the Breeding Bird Survey (BBS). Six survey visits of three days each.	Notable bird species recorded including Schedule 1, birds of Principle Importance in Wales and Red List Birds of Conservation Concern.

Significance criteria and biodiversity resource importance

16.4.14 Criteria for determining importance of ecological features have been undertaken with reference to the CIEEM Guidelines for Ecological Impact Assessment (EcIA)[23]. The assessment of importance of sites, habitats and species for biodiversity considers:

a. Designation of the site;
b. Naturalness, rarity, commonness of habitat;
c. Habitat diversity;

d. Habitat connectivity;

e. Rarity or commonness of species, either internationally, nationally or more locally, including those that may be seasonally transient;

f. Presence of endemic species, locally distinct sub-populations of a species, threated species or Red Data List species;

g. Plant communities typical of valued natural / semi-natural vegetation types;

h. Presence of rich assemblages of plants and animals; and

i. Presence of large populations of species or concentrations of species considered uncommon or threatened in a wider context.

16.4.15 Habitats and species present within the ZoI that are listed under Section 7 of the Environment (Wales) Act 2016 are also highlighted.

16.4.16 The sensitivity value of ecological receptors has been determined by its level of protection (statutory or non-statutory), its vulnerability or rarity, views of consultees, specialist expertise and professional judgement as appropriate for that receptor, with reference to the descriptions summarised in Table 16-5.

16.4.1 Baseline studies have established the relative importance of the Marine Environment resources, using the guidance in Table 3.9. of LA 108, as summarised in Table 16-5.

Table 16-5 Receptor Sensitivity/Value[36]

Value (sensitivity)	Typical descriptors
International or European importance (Very High)	Very high importance and rarity, international scale and very limited potential for substitution. Although not an exhaustive list, examples of this include: Internationally designated sites including Ramsar Site, Special Areas of Conservation (SAC), Special Protection Areas (SPA) etc). Sites proposed for international designation candidate Special Areas of Conservation (cSAC) or potential Special Protection Areas (pSPA)).

[36] Adapted from: https://www.standardsforhighways.co.uk/tses/attachments/af0517ba-14d2-4a52-aa6d-1b21ba05b465

Value (sensitivity)	Typical descriptors
	Resident or regularly occurring populations of species which can be considered at an international level where: • The loss of these populations would adversely affect the conservation status or distribution of the species at an international scale. • The population forms a critical part of a wider population at this scale. • The species is at a critical phase of its life cycle at an international scale
UK or National (High)	A nationally designated site (SSSI, ASSI, NNR, Marine Conservation Zones and Marine Protected Areas) A viable area of a priority habitat identified in Section 7 of the Environment (Wales) Act 2016, or of smaller areas of such habitat which are essential to maintain the viability of a larger whole. Any regularly occurring population of a nationally important species which is threatened or rare in the region or county. A regularly occurring significant population / number of any nationally important species, including Schedule 8 plant species on the amber list of birds of conservation concern.
Regional (Medium)	High or medium importance and rarity, regional scale, limited potential for substitution. Although not an exhaustive list, examples of this include: • Regionally important non-statutory designated sites (including heritage coasts). • Areas of habitats identified (including for restoration) in regional plans or strategies. • Resident or regularly occurring populations of species which can be considered at an international, UK or national level where: ○ The loss of these populations would adversely affect the conservation status or distribution of the species at a regional scale.

Value (sensitivity)	Typical descriptors
	○ The population forms a critical part of a wider population at this scale. ○ The species is at a critical phase of its life cycle at a regional scale. ○ Species identified in regional plans or strategies.
County (Low)	Low or medium importance and rarity, county or other unitary authority (borough or district) scale. Although not an exhaustive list, examples of this include: • Statutory and non-statutory wildlife or nature conservation sites designated at a county (or equivalent) level (including Local Wildlife Sites (LWSs), Local Nature Conservation Sites (LNCSs), Local Nature Reserves (LNRs), Sites of Importance for Nature Conservation (SINCs), Sites of Nature Conservation Importance (SNCIs) and County Wildlife Sites (CWSs)). • Areas of habitats identified in county or equivalent authority plans or strategies (such as local BAPs). • Resident or regularly occurring populations of species which can be considered at an international, UK or national level where: • The loss of these populations would adversely affect the conservation status or distribution of the species at a county (or equivalent) scale. • The population forms a critical part of a wider population at this scale. • The species is at a critical phase of its life cycle at a county (or equivalent) scale.
Local (Negligible)	Low importance and rarity, local scale. Although not an exhaustive list, examples of this include: • Local level designated sites (including all of those listed above for county level).

Value (sensitivity)	Typical descriptors
	• Areas of habitat considered to appreciably enrich the habitat resource within the local context including features of importance for migration, dispersal or genetic exchange. • Populations / communities of species considered to appreciably enrich the habitat resource within the local context including features of importance for migration, dispersal or genetic exchange.
None	Scoped out from further assessment due to limited in extent or not affected.

(adapted from Table 3.9 LA 108)

16.4.2 The assessment of the significant effects of the Scheme focuses on those ecological features identified through the baseline studies as being important. The value of an ecological feature has been determined based on professional judgement and the role of the ecological feature within the landscape, as well as considering its importance within a defined geographical context and overall resilience.

Level of Impact

16.4.3 The level of impacts on marine environment resources have been assessed in accordance with the criteria provided in Table 3.11 of LA108 as summarised in Table 16-6

16.4.4 Level of impact shall be determined by the assessment of the following characteristics:

a. positive or negative (e.g. adverse/beneficial);
b. duration (e.g. permanent/temporary);
c. reversibility (e.g. irreversible/reversible);
d. extent/magnitude; and,
e. frequency and timing.

Table 16-6 Level of impact and typical descriptions

Level of impact (Change)		Typical description
Major	Beneficial	1. Permanent addition of, improvement to, or restoration of a marine habitat or species. 2. The extent, magnitude, frequency and/or timing of an impact positively affects the integrity of key characteristics of the resource and the change is likely to restore a marine ecological receptor to favourable conservation status, or to create a feature of recognisable value within an international or national context – major beneficial effect.
	Adverse	1. Permanent/irreversible damage to a biodiversity resource. 2. The extent, magnitude, frequency and/or timing of an impact negatively affects the integrity of key characteristics of the resource – major adverse effect.
Moderate	Beneficial	1. Temporary addition of, improvement to, or restoration of a biodiversity resource. 2. The extent, magnitude, frequency and/or timing of an impact positively affects the integrity of key characteristics of the resource and the change is likely to restore a marine ecological receptor to favourable conservation status, or to create a feature of recognisable value within a regional or county context – moderate beneficial effect.
	Adverse	1. Temporary/reversible damage to a biodiversity resource. 2. The extent, magnitude, frequency and/or timing of an impact adversely affects the valued ecological receptor, but there will probably be no permanent effect on its integrity with appropriate mitigation and is reversible – moderate adverse effect.
Minor	Beneficial	1. Permanent addition of, improvement to or restoration of a biodiversity resource.

Level of impact (Change)		Typical description
		2. The extent, magnitude, frequency and/or timing of an impact positively affects the integrity of key characteristics of the resource and the change is likely to restore an ecological receptor to favourable conservation status, or to create a feature of recognisable value within a local context - minor beneficial effect.
	Adverse	1. Temporary/reversible damage to a biodiversity resource. 2. The extent, magnitude, frequency and/or timing of an impact does not affect the integrity or key characteristics of the resource. The change affects the valued ecological receptor in the short term but there will be no permanent effect (reversible) – minor adverse effect.
Negligible	Beneficial	1. Temporary addition of, improvement to, or restoration of a biodiversity resource. 2. The change is likely to restore or retain the status of an ecological receptor – negligible or slight beneficial effect.
	Adverse	1. Temporary/reversible damage to a biodiversity resource. 2. The extent, magnitude, frequency and/or timing of an impact does not affect the integrity or key characteristics of the resource – negligible or slight adverse effect.
No change		No observable impact, either positive or negative.

(*adapted from Table 3.11 LA 108*)

16.4.5 The importance of the resource/receptor (Table 16-5) and level of impact (Table 16-6) would be used to determine the significance of effect based on Table 3.13 of LA108 - significance matrix as detailed in Table 16-7

Significance Matrix

16.4.6 Significance of effects on marine ecological receptors have been assessed by referring to the matrix detailed in Table 16-7 Significance of effects have been assigned as either Major, Moderate, Minor, or Negligible and can be either adverse or beneficial. Effects that are categorised as Major or Moderate are considered as "significant".

Table 16-7 Significance Matrix

		Level of impact				
	Designation level (Sensitivity)	**No change**	**Negligible**	**Minor**	**Moderate**	**Major**
Resource Importance	**International or European (Very High)**	Neutral	Slight	Moderate or Large	Large or Very Large	Very Large
	UK or national (High)	Neutral	Slight	Slight or Moderate	Moderate or Large	Large or Very Large
	Regional (Medium)	Neutral	Neutral or slight	Slight	Moderate	Moderate or Large
	County (Low)	Neutral	Neutral or slight	Neutral or slight	Slight	Slight or Moderate
	Local (Negligible)	Neutral	Neutral	Neutral or slight	Neutral or slight	Slight

(*Source Table 3.13 DMRB LA108*)

16.4.7 Any significant impacts remaining after applying the mitigation hierarchy, known as the 'residual impacts', together with an assessment of the likelihood of success of the mitigation, are the factors which would to be considered against legislation, policy and development management in determining the Scheme.

16.4.8 Where individual environmental effects identified have been considered non-significant when assessed in isolation, the combined or cumulative impact of

these effects may result in a significant overall effect. This is particularly relevant where:

a. effects occur simultaneously or sequentially in the same geographic location;
b. receptors (e.g., habitats, species, communities) are sensitive to multiple stressors; or,
c. there is temporal overlap in the occurrence of effects, leading to prolonged exposure.

Further detail on this can be found in Chapter 17 (Cumulative Effects).

The Magnitude of ecological impact

16.4.9 The magnitude of impact on each ecological feature determined as 'important' is assessed by the predicted change from the baseline conditions and the scale of the effect. In line with CIEEM guidance[26], this considers positive or negative, extent, magnitude, duration, frequency and timing, and reversibility of ecological impacts. A distinction is also recognised between:

a) Habitats – where effects on extent, structure and functions of habitat, as well as distribution and its typical species composition need to be considered.
b) Species – where effects on abundance and distribution of that species, as well as timing of particular activities (such as breeding, nursery, overwintering, etc.) need to be considered.

16.4.10 For marine and estuarine environments, the assessment of impacts needs to consider the level of ecological connectivity as these environments are often dynamic and highly changeable, and marine and estuarine species and habitats can be vulnerable to these changes. Where there is uncertainty in effects on the marine environment, the precautionary principle has been applied.

16.5 Assumptions and limitations

16.5.1 Limitations of the survey work are included within individual habitat and species reports, as referenced above in Section 16.4. Where survey work was constrained by factors such as access and weather, this has been addressed

during the survey windows and / or has been taken into consideration during the interpretation of the results. The main limitations are summarised below:

a) Ecological surveys (such as those undertaken to inform the 2022 PEA) are limited to factors which affect the presence of species, such as time of year, migration patterns and behaviour, while the extent of surveyed area could be limited by the safety concern of surveyor.

b) It is possible that certain species may have been overlooked or under-recorded during the surveys; specifically, the intertidal survey was not conducted at an optimal time of the year. As such, further surveys were completed on the 7th July 2025, provided in Appendix 16B, Volume 3.

c) Benthic fauna within the subtidal and intertidal zones have not been surveyed or assessed, therefore the assessment of species presence is based on a desk-based study, therefore the level of knowledge and assessment of impact on benthic fauna is limited.

d) Records for the European smelt have been collected for the months of May, September, and October in 2014. Given that the data is now over ten years old, this is outdated information.

e) No site-specific surveys were undertaken for migratory fish and therefore the baseline is informed by desk study only. In addition, the results of fish catches at Chester Weir for sea and river lamprey (*Petromyzon marinus* and *Lampetra fluviatilis*, respectively), and monthly run estimates for adult Atlantic salmon (*Salmo salar*) and brown/sea trout (*Salmo trutta*), were provided by NRW.

f) The distance at which underwater and airborne noise and vibration may propagate is unknown, as well as the frequency (Hertz) or volume (decibels) of the noise at source. Though the impact of underwater noise produced during pile driving operations has not been modelled, an underwater noise assessment has been undertaken based on existing literature and professional judgement (Appendix 16C, Volume 3), which includes the assessment of effects on receptors such as migratory fish species.

16.5.2 The distance or area of suspended sediments caused by in-river construction activity and the level and duration of the turbidity changes caused is unknown. Furthermore, the distance or area of resuspended contaminated sediments from in-river construction activity is also unknown, as well as the presence or levels of contaminants or duration of persistence. In the absence of detailed information to inform the assessment of significant effect, a precautionary approach will assume a worst-case scenario that effects from underwater and airborne noise, suspended sediments and resuspension of potentially contaminated sediments could be both likely and significant. However, by adopting best practice methods and including provisions for pollution control measures in accordance with Guidance for Pollution Prevention (GPP), these risks can be managed to acceptable levels. These mitigation measures would be

set out in the CEMP that would be prepared by the Contractor and submitted to NRW for approval at least eight weeks prior to site mobilisation.

16.5.3 These limitations and assumptions have been considered in the assessment of relevant effects, and a precautionary approach is applied as needed to confirm the assessment is robust.

16.6 Baseline Conditions

16.6.1 The baseline information within the ZoI of the Scheme has been compiled using intertidal survey data, along with desk-based studies of the wider area, as well as the EIA Scoping Report (provided in Volume 3, Appendix 4A).

16.6.2 Baseline details in relation to water quality, including background for turbidity, are discussed in Chapter 7 (Water Environment).

Designated sites

16.6.3 Designations with marine or intertidal features have been summarised in the following sections, locations of these are provided in Figure 16.1, Volume 2.

16.6.4 Chapter 8 (Terrestrial Biodiversity) provides a full list of designated sites and Figures 8.1 and 8.2 in Volume 2 outlines the locations of these.

Statutory designations

The Dee Estuary Ramsar Site

16.6.5 The Dee Estuary Ramsar is located 1km north-west of the Scheme. This wetland is designated as it qualifies under Criterion 1 because it contains a representative, rare, or unique example of a natural or near-natural wetland type found within the appropriate biogeographical region. The following Annex 1 features are also supported:

a) H1130 Estuaries;

b) H1140 Mudflats and Sandflats not covered by seawater at low tide;

c) H1210 Annual vegetation of drift lines;

d) H1230 Vegetated sea cliffs of the Atlantic and Baltic coasts;

e) H1310 Salicornia and other annuals colonising mud and sand H1330 Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*);

f) H2110 Embryonic shifting dunes;

g) H2120 Shifting dunes along the shoreline with *Ammophila arenaria* (“white dunes”);

h) H2130 Fixed dunes with herbaceous vegetation (“grey dunes”); and,

a) H2190 Humid dune slacks.

16.6.6 The site qualifies under Criterion 2 as it supports a breeding colony of the vulnerable Natterjack toad (*Bufo calamita*). The site also regularly supports 20,000 or more waterbirds, qualifying under Criterion 5.

16.6.7 The site qualifies under Criterion 6 because it regularly supports 1% of the individuals in the populations of waterbirds in any season, as listed above for the SPA assemblage qualification.

The Dee Estuary Special Protection Area (SPA)[37]

16.6.8 The Dee Estuary SPA is located 1km north-west of the Scheme and qualifies under Article 4.1 of the Directive (79/409/EEC) as it is used regularly by 1% or

[37] Natural England, 2014. European Site Conservation Objectives for Dee Estuary SPA (UK9013011). Available at: European Site Conservation Objectives for Dee Estuary SPA - UK9013011

more of the Great Britain populations of the following species listed in Annex I in any season:

a) Bar-tailed godwit (*Limosa lapponica*) (wintering)*;*
b) Common tern (*Sterna hirundo*) (breeding);
c) Little tern (*Sterna albifrons*) (breeding); and
d) Sandwich tern (*Sterna sandvicensis*) (autumn passage).

16.6.9 Qualifying under Article 4.2 of the Directive (79/409/EEC) as it is used regularly by 1% or more of the biogeographical populations of the following regularly occurring migratory species (other than those listed in Annex I) in any season:

a) Redshank (*Tringa totanus*) (passage and wintering);
b) Shelduck (*Tadorna tadorna*) (wintering);
c) Teal (*Anas crecca*) (wintering);
d) Pintail (*Anas acuta*) (wintering);
e) Oystercatcher (*Haematopus ostralegus*) (wintering);
f) Grey plover (*Pluvialis squatarola*) (wintering);
g) Knot (*Calidris Canutus islandica*) (wintering);
h) Dunlin (*Calidris alpina)* (wintering);
i) Black-tailed godwit (*Limosa limosa islandica*) (wintering); and
j) Curlew (*Numenius arquata*) (wintering).

16.6.10 The site also qualifies under Article 4.2 of the Directive, as it is a site of major importance to birds, used regularly by over 20,000 waterbirds, supporting Great Crested Grebe (*Podiceps cristatus)*, Cormorant (*Phalacrocorax carbo)*, Shelduck, Wigeon (*Anas penelope)*, Teal, Pintail, Oystercatcher, Grey plover, Lapwing (*Vanellus Vanellus)*, Knot (*C. canutus)*, Sanderling (*Calidris alba)*, Dunlin, Black-tailed godwit, Bar-tailed godwit (*L. lapponica)*, Curlew and Redshank.

River Dee and Bala Lake / Afon Dyfrdwy a Llyn Tegid SAC[38]

16.6.11 The Scheme is located within the River Dee and Bala Lake SAC, designated for the following species:

a) Bullhead (*Cottus gobio)*;
b) River lamprey (*Lampetra fluviatilis)*;
c) Brook lamprey (*Lampetra planeri)*;
d) Floating water-plantain (*Luronium natans)*;
e) Otter (*Lutra lutra)*;
f) Sea lamprey (*Petromyzon marinus)*; and
g) Atlantic salmon (*Salmo salar)*.

16.6.12 The habitat Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation is also designated under the SAC.

Dee Estuary / Aber Dyfrdwy SAC

16.6.13 The SAC is located 1km north-west of the Scheme, designated for the following Annex I habitats that are a primary reason for site selection:

a) Mudflats and sandflats not covered by seawater at low tide;
b) Salicornia and other annuals colonising mud and sand;
c) Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*);

16.6.14 Annex I habitats present as a qualifying feature, though not a primary reason for site selection comprise:

a) Estuaries;
b) Annual vegetation of drift lines;
c) Vegetated sea cliffs of the Atlantic and Baltic Coasts;
d) Embryonic shifting dunes;
e) "Shifting dunes along the shoreline with *Ammophila arenaria* (""white dunes"")";

[38] https://sac.jncc.gov.uk/site/UK0030252

f) "Fixed coastal dunes with herbaceous vegetation (""grey dunes"")"; and

g) Humid dune slacks.

16.6.15 Anex II species present as a qualifying feature comprise:

a) Sea lamprey (*P. marinus)*;

b) River lamprey (*L. fluviatilis)*; and

c) Petalwort *(Petalophyllum ralfsii).*

Dee Estuary / Aber Afon Dyfrdwy SSSI[39]

16.6.16 Located 1km north-west of the Scheme and designated for its total populations of internationally important wintering waterfowl and individual waterfowl and tern species. Also designated for its intertidal mud and sandflats, saltmarsh and transitional habitats; the hard rocky sandstone cliffs of Hilbre Island and Middle Eye with their cliff vegetation and maritime heathland and grassland; its assemblage of nationally scarce plants; and its populations of Sandhill Rustic Moth (*Luperina nickerlii gueneei*). European smelt (*Osmerus eperlanus)* is also noted for its presence.

Afon Dyfrdwy (River Dee) SSSI[40]

16.6.17 The Scheme is located within the SSSI, which is of special interest for its fluvial geomorphology, Carboniferous geology and range of river habitat types and species. These include saltmarsh transition habitats, populations of floating water plantain (*L. natans)*, slender hare's-ear (*Bupleurum tenuissimum)*, sea barley (*Hordeum marinum)*, hard-grass (*Parapholis strigose*), Atlantic salmon (*S. salar)*, Bullhead (*C. gobio)*, Brook lamprey (*L. planeri)*, River lamprey (*L. fluviatilis)*, Sea lamprey (*P. marinus),* European smelt *(O. eperlanus)* and aquatic invertebrates.

River Dee (England) SSSI[41]

16.6.18 Though within the same river, the River Dee two separate designations, one for Wales and England. The River Dee SSSI is located 7km upstream of the

[39] CYNGOR CEFN GWLAD CYMRU
[40] CYNGOR CEFN GWLAD CYMRU
[41] Site name:

Scheme and is notified for its nationally important transition through a range of river types from mesotrophic to eutrophic. It is also notified for Atlantic salmon (*S. salar)*, otter (*L. lutra)*, European smelt (*O. eperlanus*) club-tailed dragonfly (*Gomphus vulgatissimus)* and fluvial geomorphology.

Dee Estuary (England) SSSI[42]

16.6.19 Located 7km north-west of the Scheme and forming the northern half of the Dee Estuary, the SSSI is of interest for its populations of internationally important waterfowl, whose numbers reach national and in some cases, internationally important levels; comprising oystercatcher (*H. ostralegus)*, knot (*C. canutus)*, curlew (*N. arquata)*, redshank (*T. totanus)*, bar-tailed godwit (*L. lapponica)* black-tailed godwit (*L. limosa)*, grey plover (*P. squatarola)* and dunlin (*C. alpina)*. It is also of importance for its intertidal mud and sandflats, saltmarsh and transitional habitats; the hard rocky sandstone cliffs of Hilbre Island and Middle Eye with their cliff vegetation and maritime heathland and grassland.

Designated Shellfish Waters

16.6.20 The proposed Scheme is located 9km upstream of the Dee (West) and Dee (East) Shellfish Water sites, designated under the Water Framework Directive (WFD). The Scheme is also located 10km upstream of a classified bivalve mollusc harvesting area, specifically for blue mussel (*Mytilus edulis*) and common cockle (*Cerastoderma edule*).

16.6.21 The Dee supports important fish stocks; and the outer estuary acts as a nursery ground for several fish species (see Section 16.6.38). Both salmon and sea trout are commercially important in the estuary and the Dee supports a salmon net fishery controlled by a Net Limitation Order. There is also a fishery for brown shrimp (*Crangon crangon*) between May and July[43],[44]. Whitebait and sand eels (*Ammodytes* spp.) within the estuary create a food resource for the estuaries' breeding tern colonies (NCC, 1978).

[42] SSSI detail - Designated Sites View
[43] Natural England (2010). The Dee Estuary European Marine Site. 259pp..
[44] North Western IFCA (2025). Status of the brown shrimp (Crangon crangon) fishery: 31 pp.

Non-Statutory designations

16.6.22 Details on Local Wildlife Sites (LWS) are outlined in Table 8-12 within Chapter 8 (Terrestrial Biodiversity). One LWS with marine features was identified and has been summarised below.

16.6.23 The River Dee LWS comprises a coastal and floodplain grazing marsh, coastal saltmarsh, mudflats, and is of ornithological interest. The site is located 420m north-west of the Scheme.

Marine Habitats

16.6.24 Habitats have been summarised from the intertidal survey report (Appendix 16A, Volume 3; Document Reference: 395318-RML-00-XX-RP-L-0014) and a summary is provided in the following paragraphs. Though recorded as saltmarsh, the survey was not conducted at an optimal time of the year. As such, further surveys took place on the 7th July 2025 and integrated below. The survey report is provided in Appendix 16B, Volume 3 (Doc Ref: 395318-RML-00-XX-RP-L-0012).

16.6.25 The intertidal habitats within the study area on the south side of the tidal river Dee (west abutment) comprises steep banks with saltmarsh and scrub on the upper littoral (saltmarsh LS.LMp.Sm); however, directly under the existing bridge structure, the upper littoral comprises littoral mud (LS.LMu), the absence saltmarsh likely due to the shading effect of the existing bridge.

16.6.26 The subtidal habitat includes substrate from the mid to lower littoral comprised fine sandy mud with scattered rocks and debris, forming the biotope type Polychaete/oligochaete-dominated upper estuarine mud shores (LS.LMu.UEst). Directly under the existing bridge structure, the lower littoral featuring muds with gravels and cobbles forming littoral mixed sediment (LS.LMx).

16.6.27 The northern bank of the River Dee is also backed by saltmarsh, dominated by sea purslane (*Sesuvium portulacastrum*), followed by common saltmarsh-grass (*Puccinellia maritima*), which is interspersed with Babington's orache (*Atriplex glabriuscula*) and sea plantain (*Plantago maritima*). This is bordered from above

by common couch (*Elytrigia repens*) or sea couch (*E. atherica*) (or a combination of the two) interspersed with sea aster (*Tripolium pannonicum*) and sea beet (*Beta vulgaris subsp. Maritima*). Mown semi-improved neutral grassland borders this upper saltmarsh.

16.6.28 On the south bank, these consist predominantly of a *P. maritima* dominated community which can be attributed to the SM13 *P. maritima* salt-marsh community (*Puccinellia maritima*) National Vegetation Classification (NVC) community. The north bank was characterised by two distinct stands of plant assemblages representing different saltmarsh habitat zonations. The upper saltmarsh habitat has a closed-sward dominated by *E. repens* with frequent *Atriplex littoralis* and *B. maritima*. This then transitions into the lower saltmarsh where *S. portulacastrum* is dominant.

16.6.29 The upper- to mid-littoral comprises a mosaic of sandy mud (littoral sandy mud LS.LMu). Consistent with the south side of the river, saltmarsh is absent beneath the existing bridge structure on the north side.

16.6.30 The existing bridge structure is concrete and features tubular green seaweeds, brown algae and barnacles on the existing bridge piers below the Mean High Water Spring (MHWS) mark.

16.6.31 At the location of the proposed new bridge, the northern bank of the River Dee is dominated by tall common couch or sea couch (or a hybrid of the two), with abundant sea purslane dominating towards the lower saltmarsh zone with intertidal mud below that. The southern bank of the River Dee and the Queensferry Drain outflow are dominated by scrub and intertidal mud, with scattered saltmarsh species in between.

Fish spawning and nursery grounds

16.6.32 The subtidal zone of the Dee Estuary is an important breeding, sheltering and nursery area for coastal fish species[45], however, this is in the outer areas where there is coarse sand and gravel substrate.

16.6.33 The outer Dee Estuary, which is 10-15km away from location of the Scheme, is a spawning area for sprat (May – August)[46]. The estuary is also a low intensity spawning area for cod (*Gadus morhua*), whiting (*Merlangius merlangus)*, mackerel (*Scomber scombrus),* plaice (*Pleuronectes platessa*) and sole *(Solea solea*)[47].

16.6.34 The Dee Estuary is also a nursery area for herring, whiting, plaice (*P. platessa*) (low intensity) and sole (*S. solea*) (high intensity)[46]. The estuary is also a low intensity nursing ground for tope shark (*Galeorhinus galeus*), thornback ray (*Raja clavata*), spotted ray (*Raja montagui*), angler/monk fish (*Lophius piscatorius*) and sand eel. A high intensity nursing ground for herring, cod and whiting[47].

16.6.35 The Dee Estuary SSSI is also notable for its presence of smelt (*O. eperlanus*), the estuary (≥1km away from proposed works) provides crucial spawning and nursery grounds for this species[39].

16.6.36 Habitats further upstream in the River Dee and Bala Lake SAC, particularly in the proposed works area, comprise of subtidal mud. It is important to note that this is not a suitable substrate for fish spawning grounds. Species such as herring, European smelt, and elasmobranch species, such as tope shark and thornback rays, typically use gravel, gravelly sand or sand substrate in the outer Estuary as their suitable spawning ground habitat[46].

[45] JNCC, 2013. Ramsar Information Sheet: UK11082 [online] Available at: https://rsis.ramsar.org/RISapp/files/30642347/documents/GB298_lit161209.pdf
[46] Coull, K., Johnstone, R. and Rogers, S. (1998) Fisheries sensitivity maps in British Waters. UKOOA Ltd, Aberdeen, pp. 63
[47] Ellis, J., Milligan, S.P., Readdy, L., Taylor, N. and Brown, M.J. (2012) Spawning and nursery grounds of selected fish species in UK waters. Science Series Technical Report, Cefas Lowestoft, pp. 147:56.

Priority Habitats

16.6.37 Table 16-8 lists the marine habitats found within or adjacent to the scheme and whether these habitats are listed as Priority Habitats in Section 7 of the Environment (Wales) Act 2016. A value for their ecological significance has also been assigned.

Table 16-8 Summary of habitats and value of resource importance

Habitat Ref	Habitat description	Priority Habitat	Value/justification
G2	Running water	Yes	International the Tidal River Dee is a priority habitat as well as being designated as a SAC/SSSI. Local/ the Queensferry Drain provides biodiversity within an urban context as well as meeting other planning biodiversity objectives.
H1.1	Intertidal mud / sand	Yes	National although limited in its extent at the location of the Scheme, intertidal mud / sand is a feature of the River Dee SSSI. It is a priority habitat and an Annex I habitat of the Dee Estuary SAC 1km downstream (mudflats and sand flats not covered by sea water at low tide).
H2.6	Saltmarsh	Yes	National although limited in its extent at the location of the Scheme, saltmarsh is a feature of the River Dee SSSI. It is a priority habitat and an Annex I habitat of the Dee Estuary SAC 1km downstream (saltmarsh is covered within Atlantic salt meadows).

Protected and Notable Species

Fish

16.6.38 For the purposes of this chapter, species have been grouped into the following categories:

a) Migratory fish species protected under the Wildlife and Countryside Act (1981): ***High*** sensitivity

b) Other fish species: ***Low to Negligible*** sensitivity

16.6.39 The desk study identified four records within a 2.0km search radius within the last ten years. These comprised brown trout / sea trout (*Salmo trutta)*, bullhead (*C. gobio)* and European eel (*Anguilla Anguilla*), all within Wepre Brook, located

approximately 1.75km from the Scheme location and Allis shad (*Alosa alosa*) have been recorded in the River Dee.

16.6.40 The Dee Estuary also supports several migratory fish species including river lamprey (*L. fluviatilis*); sea lamprey (*P. marinus*); Atlantic salmon (*S. salar*); sea trout (*S. trutta*); twaite shad (*Alosa fallax*); European smelt (*Osmerus eperlanus*) and European eels (*A. anguilla*).

16.6.41 Bullhead are a feature of interest of the River Dee and Bala Lake SAC; however, this species is a freshwater fish confined to the river above the tidal limit at Chester Weir (located 11km upstream of the Scheme) and will not be affected by the proposed Scheme.

16.6.42 Brown / sea trout is listed as a species of least concern on the International Union for Conservation of Nature (IUCN) Red List[48] Allis Shad is listed as Critically Endangered[49] both are Section 7 species. European eel is listed as critically endangered on the IUCN Red list[50] and is a Section 7 species.

16.6.43 European eel will likely feed and be resident in the channelised section of the tidal River Dee. In addition, River Lamprey primarily reside in estuaries feeding on estuarine fish, such as Herring (*Clupea harengus*) and flatfish (Pleuronectidae) (Maitland 2003)[51] and are expected to be present migratory fish within the Dee Estuary.

16.6.44 European smelt are a feature of both the River Dee and Dee Estuary SSSI. NRW provided records of European smelt and their locations where netted/trawled, the locations are provided on Figure 16.2, Volume 2 of the ES. Smelt is listed on the (IUCN) Red List as Least Concern.

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[48] Freyhof, J. 2011. *Salmo trutta*. *The IUCN Red List of Threatened Species*2011: e.T19861A9050312. http://dx.doi.org/10.2305/IUCN.UK.2008.RLTS.T19861A9050312.en. [Accessed 06/03/25]
[49] Ford, M. 2024. *Alosa alosa (Europe assessment)*. *The IUCN Red List of Threatened Species* 2024: e.T903A221184262. https://dx.doi.org/10.2305/IUCN.UK.2024-2.RLTS.T903A221184262.en. [Accessed 06/05/25]
[50] Pike, C., Crook, V. & Gollock, M. 2023. *Anguilla anguilla (Europe assessment)*. *The IUCN Red List of Threatened Species* 2023: e.T60344A216177498. [Accessed 06/05/25]
[51] Maitland, P.S., 2003. Ecology of the river, brook and sea lamprey. Conserving Natura 2000 Rivers Ecology Series No. 5. Peterborough (English Nature).

16.6.45 Fish species that migrate through the River Dee and under the location of the existing and proposed bridges include those which are features of interest of the designated sites. These are Atlantic salmon, sea lamprey (*P. marinus*), river lamprey and European smelt. Information regarding sea lamprey, brook lamprey, Atlantic salmon, sea trout and European smelt has been obtained from NRW. Full results are provided in Appendix 16D.

16.6.46 Artificial light at night from illuminated bridges can reach aquatic habitats, such as rivers, which in turn can threaten the river's natural heterogeneity and alter the behavioural responses of migratory fish[52]. An Environmental Lighting Impact Assessment (ELIA) for the Scheme was completed in August 2025 (Doc ref: 395318-MMD-00-XX-RP-E-0009), with three receptor locations adjacent to the River Dee (E03, E04 and H02).

Anadromous and Marine Fish Species

Lamprey species

16.6.47 Based on the Chester Weir fish trap data (Appendix 16D, Volume 3), peak migration for sea lamprey is between May and July, with river lamprey migration occurring from February to April, with peak numbers observed in February. Brook lamprey has not been considered in this assessment as they do not descend into the tidal zone and are therefore deemed not to be affected by the Scheme.

16.6.48 Lamprey are considered to be of international significance as they are a feature of the Dee Estuary SAC.

European smelt

16.6.49 Records for the European smelt have been collected for the months of May, September, and October in 2014. The locations of where European smelt have been caught is provided on Figure 16.2, Volume 2 of the ES. The largest total

[52] Pérez Vega, C., Jechow, A., Campbell, J., Zielinska-Dabkowska, K., & Hölker, F. 2024. Light pollution from illuminated bridges as a potential barrier for migrating fish–Linking measurements with a proposal for a conceptual model. Basic and Applied Ecology **74**: 12pp.

count at any one time was of 179 individuals on the 10th October 2016 at the Grindes – Seine Net located upstream of the River Dee Crossing.

16.6.50 European smelt are of national significance due to their importance as an indicator species of water quality, meaning their presence or absence can reveal the health of the ecosystem. Furthermore, they also serve as a crucial food source for fish-eating birds and other fish, such as sea trout and sea bass[53].

Salmon and sea trout

16.6.51 Results of fish catches for salmon and sea trout (2009 – 2025) provided by NRW, indicate both species generally have their peak migration periods from June to August. Outside of this period, autumn was notable for the passage of smolts, though these were limited in numbers, with the exception of salmon from 2009 – 2012 where numbers were comparable to the previous months. The peak migration period for smolts is in April and May.

16.6.52 Atlantic salmon and sea trout are of international importance, as they are features due to their ecological role as indicators of freshwater and marine health, and their significant economic and social value through fisheries and tourism. They are protected under international conventions like the UN Convention for the Conservation of Salmon and OSPAR convention, reflecting their global significance[54].

16.6.53 Generally, the River Dee has continued to see Atlantic salmon and sea trout stocks decline, to the extent that stocks are now approaching unsustainable population levels. Salmon stocks in all 23 principal salmon rivers in Wales, including the River Dee are now classed as “At Risk”, highlighting the continued decline in numbers[54].

[53] https://canalrivertrust.org.uk/things-to-do/fishing/caring-for-our-fish/freshwater-fish-species/rare-and-protected-fish/smelt
[54] Natural Resources Wales / Vulnerable salmon and sea trout continue to decline despite conservation efforts from anglers and nets

Summary

16.6.54 Taking the peak migration times for both salmonids and lamprey, the most sensitive period for these species is February for river lamprey and from May – September inclusive for sea lamprey and salmonids.

16.6.55 Recognising that the Atlantic salmon, sea and river lamprey are features of interest of the SACs and occur within the Dee at the location of the Scheme, these species are considered to be of international significance.

European eel

16.6.56 The Dee Estuary and River Dee also support European eel (*A. anguilla*). They may also inhabit Queensferry drain, though none were observed during terrestrial ecology surveys for water voles and otters, presence should be assumed.

Marine benthic invertebrates

16.6.57 The Dee Estuary supports a diverse array of marine invertebrates, particularly within its extensive intertidal mudflat and sandflat habitats, containing benthic species such as ragworm (*Hediste diversicolor*), with small areas of barnacles (*Semibalanus balanoides* and/or *Balanus crenatus*) and the common periwinkle (*Littorina littorea*) on cobbles at low water. The mud includes a wide band of light airy impoverished sand which contains low numbers of the amphipod shrimps *Corophium* sp. and *Bathyporeia* sp.

16.6.58 The scheme area is generally sheltered but subject to moderately strong tidal streams and reduced salinity (description taken from CCW intertidal survey standard report in 2002[55]). During the baseline survey, polychaete worms (most likely *H. diversicolor*) were found under rubble in the intertidal zone, south-west of the existing A494 Bridge.

[55] CCW, 2002. 11.52.3 Queensferry Bridge to Connahs Quay Bridge Phase 1 Intertidal Report: Countryside Council for Wales.

Birds – waterbirds and waders

Wintering waterbirds and waders

16.6.59 The Dee Estuary is a large funnel-shaped, sheltered estuary and is one of the top ten estuaries in the UK for wintering and passage waterfowl populations. The estuary supports internationally important numbers of waterfowl and waders[56].

16.6.60 Four seasons of overwintering bird surveys have been completed (2018/19, 2020/21, 2022/23 and 2024/25) and results of these have been summarised below, for full results refer to the Non-Breeding Bird Technical Reports (Appendix 9B, Volume 3).

16.6.61 Three species designated under the Dee Estuary SPA were identified during the 2024-25 surveys comprising Redshank, Teal and Oystercatcher. Other birds recorded that were listed under waterbird assemblage qualification were also noted, these include: lapwing, cormorant, ringed plover, little egret, gadwall and wigeon. None were recorded at significant numbers (>1% of the national population).

16.6.62 Three species, Shelduck, Black-tailed Godwit and Dunlin, though not noted in the 2022/23 or 2024/25 surveys, were identified from previous surveys completed in 2018/19 and 2020/21. No other qualifying species were recorded in the survey area in any of the other completed survey seasons.

16.6.63 Suitable habitats for wintering birds comprise the river itself, mudflats, saltmarsh, grassland and arable fields within the study area.

16.6.64 Surveys conducted in the winters of 2018/2019 to 2024/2025 highlight how the areas affected by the Scheme are utilised by overwintering bird assemblages which are a feature of interest of the SPA/Ramsar sites, as well as other notable species.

Breeding waterbirds and waders

[56] https://rsis.ramsar.org/ris/298

16.6.65 Breeding bird surveys were completed in 2021 and 2023, with additional surveys conducted in 2024 but limited to the formerly proposed Airbus Load Out Facility (ALOF) site only (Document Reference: 395318-MMD-00-XX-RP-Z-0011).

16.6.66 In 2025, breeding bird surveys were also undertaken for the full scheme area and the survey report will be included as an addendum to the ES and HRA at a later date.

16.6.67 The Dee Estuary Ramsar/SPA are designated for the following species during the breeding season (March-August):

a) Common tern (*S. Hirundo*); and
b) Little tern (*S. albifrons*).

16.6.68 The Dee Estuary Ramsar/SPA sites support several internationally important breeding bird species and assemblages. The Scheme is located 1km from these sites; however, birds are mobile and so will utilise other areas along the River Dee. These areas include the intertidal habitats (for loafing, roosting, foraging, and refuge) and adjacent fields and sand bars (for high tide refuge, depending on food availability and the state of the tide).

16.6.69 Designated species that were recorded and are supported by the Dee Estuary Ramsar/SPA (little egret, redshank, teal, and oystercatcher) within the survey area did not reach or exceed significant thresholds of 1% or more of the designated site population.

16.6.70 It is reasonable to assume that given the combination of a comprehensive desk study (including a BTO-commissioned Data Report) and detailed survey data generated via fieldwork undertaken by experienced professional ornithologists over several years, the desk and field data are relatively robust and broadly capture the non-breeding season avifaunal assemblage across the Scheme footprint and/or its two associated 10km National Grid squares.

16.6.71 Valuable habitats and features for birds in the breeding season include the tree lines, hedgerows and scrub, grassland and arable land particularly during high tide. The River Dee which intersects the Scheme survey area and footprint

appears to support a moderate number of species (>21) including common sandpiper, cormorant, oystercatcher, redshank, goosander, lapwing, grey heron, little egret, turnstone, moorhen, mallard, gadwall (*Mareca strepera*), shoveler (*Spatula clypeata*), teal (*A. crecca*), tufted duck (*Aythya fuligula*), wigeon (*A. penelope*), great crested grebe (*P. cristatus*), little grebe (*Tachybaptus ruficollis*), greylag goose (*Anser anser*) pink-footed goose (*Anser brachyrhynchus*), Canada goose (*Branta canadensis*), common gull (*Larus canus*), great black-backed gull (*Larus marinus*), herring gull (*Larus argentatus*), lesser black-backed gull (*Larus fuscus*).

16.6.72 Small rocky embankments which are exposed during low tide only are considered to be of importance to roosting lapwing, redshank, cormorant, oystercatcher, mallard, and gull species, including herring, black-headed, lesser and greater black-backed gull.

16.6.73 Survey results gathered between 2018 and 2025 estimated the value of a maximum of importance at the county level for conservation.

16.6.74 The study area supports several bird species of conservation concern; however, many species appeared to be in relatively low numbers within the Scheme footprint compared to the surrounding areas and beyond the ZoI extents. This is likely attributable to current levels of anthropogenic disturbance from roads, footpaths, cycle paths, a shooting range, and industrial activity within the Scheme footprint.

16.6.75 The desk study and field data also indicated the significance of the habitats within the ZoI, which could be important for the populations of several species. These habitats would be protected by appropriate mitigation and enhancement measures. The following habitats and features within the ZoI have been identified as valuable to breeding birds:

- The river and riverbank habitat, particularly during low tide provide an important commuting, foraging and roosting area for various waterbirds, such as lapwing, common sandpiper, redshank, kingfisher, cormorant, mallard, oystercatcher, Canada goose, coot, grey wagtail, and gull species. The majority of these species were recorded in relatively low numbers; however, a greater number of

birds, particularly goose, duck and smaller waders, could be observed at a distance outside of the survey area towards the western extent (i.e. towards the coastline). This area had more suitable breeding habitat, such as the Dee Estuary and Tata Steelworks, which are known to support breeding colonies of common terns and black-headed gulls. No common or little terns were observed or recorded within the survey area. Up to 60 black-headed gulls were recorded roosting and foraging on the banks throughout the surveys. In 2023, there was an avian flu outbreak at Tata Steelworks and black-headed gull reproductive output was reported to be extremely low. More recently, Welsh Government state that all of Wales is an Avian Influenza Prevention Zone (28/01/25).

- The industrial and commercial properties along the river offer suitable nesting habitat for herring gulls (2025 peak count 91) and lesser black-backed gulls (2025 peak count 58). Multiple pairs were observed building nests and attending to young throughout the surveys. The actual number of nest sites could not be confirmed due to surveyors' visual obstruction. The birds appeared to favour the Scottish Power building located on Factory Road. During the 2025 breeding bird surveys, little ringed plover (*Charadrius dubius*) was observed on two occasions in a possible family group (3 individuals) utilising areas of stockpiled gravel in commercial yards along the south bank, the species is considered to be a probable breeding species within the Scheme survey area.

- Ringed Plover (*Charadrius hiaticula*) were also observed foraging along the intertidal area/riverbanks.

Designated birds

16.6.76 Three SPA designated species, namely redshank (*T. totanus)*, oystercatcher (*H. ostralegus)*, and cormorant (*P. carbo)*, were recorded within the ZoI. These species were not recorded in numbers considered significant (i.e. less than 1% of the population found within the SPA). No species associated with the SPA designated for their breeding abundance (common tern or little tern) were recorded in all survey years.

16.6.77 The open water and intertidal habitats support functional species assemblages such as black-headed gull (*Chroicocephalus ridibundus*), common sandpiper, coot, cormorant, herring gull (*L. argentatus*), mallard, moorhen, oystercatcher and redshank which typically thrive in wetland, estuarine and coastal habitats.

Marine mammals

16.6.78 There are several species of marine mammals found in the Dee Estuary, including the harbour porpoise (*Phocoena phocoena)*, grey seal (*Halichoerus grypus)* and the harbour seal (*Phoca vitulina*), though these were predominantly confined to the mouth of the Dee Estuary where they travel up and down the Irish Sea foraging[57].

16.6.79 Strandings data[58] for 2018 – 2021 in Flintshire show that the below marine mammals are in the Dee estuary area at Talacre:

a) Fin whale (*Balaenoptera physalus*) (sandbank on the River Dee), one record in 2020;

b) Harbour porpoise *(P. phocoena*); and

c) Grey seal (*H. grypus*).

16.6.80 The Scheme area is deemed unsuitable for many marine mammal species, due to its shallow nature and distance from the open sea, however, grey seal have previously been sighted up the river during high tide at Flint Castle[59] and in 2006, a seal was spotted as far upstream as Old Dee Bridge[60]. These are rare occurrences and the seal populations in this region are mainly found at the mouth of the Dee Estuary.

[57] https://ourdeeestuary.co.uk/wildlife-2/
[58] Marine Environmental Monitoring. Annual Reports for Marine Mammal and Turtle strandings. Available at:

Annual Reports – Strandings Wales

[59] WATCH: Seal caught splashing about in the Dee Estuary | The Leader
[60] Seal Dee-light - Cheshire Live

Invasive Non-Native Species (INNS)

16.6.81 No INNS were identified during the March 2025 intertidal walkover surveys (Appendix 16A, Volume 3).

16.6.82 Chinese mitten crab (*Eriocheir sinensis*) was recorded 1,735m from the Scheme in Wepre Brook. The first record of the Chinese mitten crab in North Wales was made in the River Dee in 2006. In their report, NRW state that a substantial population is thought to be present on the River Dee, however this is based on anecdotal evidence.

16.6.83 The Chester Weir fish trap has captured a total of 234 Chinese mitten crabs since 2007, 94% of which were caught in the months of September and October[61]. The NRW report suggests that the canalised section of the River Dee between Connah's Quay and Saltney (which includes the areas subject to this assessment) does not appear to be favourable habitat due to a lack of vegetation below MHWS; however, evidence suggests that the River Dee population size and geographical range is gradually increasing[62,61].

Summary evaluation of ecological baseline

16.6.84 It is impractical for an assessment of the ecological effects of the Scheme to consider every species and habitat that would be affected; instead, it focuses on 'Valued Ecological Receptors' (VERs) based on their legal protection, designation, rarity etc and whether they are significantly affected by the Scheme.

16.6.85 Species and habitats which are considered to be widespread, not threatened and resilient to the Scheme effects, and which will remain viable and sustainable, have been scoped out of the assessment. The habitats listed in Table 16-9 which are not Priority habitats, but are of local importance, are not considered to be VERs. They are considered important in terms of their

[61] Natural Resources Wales (2022) Dee Stock Assessment Programme. Angler Report 2022: 16pp.
[62] Natural Resources Wales (2016) Monitoring of Chinese Mitten Crabs (*Eriocheir sinensis*) on the River Dee. Report No. 154. 90pp.

biodiversity value and therefore mitigation measures are required. General mitigation measures are recommended in **Section 16.7.**

16.6.86 Table 16-9 provides a summary of the VERs, their assigned sensitivity value, and justification for inclusion.

Table 16-9 Summary of Valuable Ecological Receptors (VERs)

VER	Value (sensitivity)	Justification
Statutory Designated Sites		
Dee Estuary SPA	International	Designated due to its assemblages of waterfowl and wetland birds and habitats. Only three qualifying bird species of the SPA (teal, redshank and oystercatcher) were recorded in the survey area, and none were recorded in significant numbers (>1% of the SPA population). No direct or indirect damage to habitats or species is considered likely to occur. In addition, it is considered that the associated effects from construction noise would not significantly disturb the aggregations of roosting, loafing or feeding waterfowl. However, there may be indirect effects to associated habitats which are used, affecting their foraging habitat. Noise from construction may temporarily displace birds.
Dee Estuary Ramsar	International	Due to its assemblages of waterfowl and wetland birds and habitats. Other waterbirds for which the Ramsar are designated for were recorded but, again none were recorded at significant numbers (>1% of the national population). No direct or indirect damage to habitats or species is considered likely to occur. In addition, it is considered that the associated effects from construction noise would not significantly disturb the aggregations of roosting, loafing or feeding waterfowl. However, there may be indirect effects to associated habitats which are used, affecting their foraging habitat. Noise from construction may temporarily displace birds.
Liverpool Bay SPA	International	Due to supporting large aggregations of wintering red-throated diver and common scoter, as well as important

VER	Value (sensitivity)	Justification
		marine foraging areas of little terns breeding within The Dee Estuary SPA. This designated site will not be directly affected by the Scheme works during construction and operation; however, the Vessel Mobilisation Outline Method Statement confirms that the proposed vessel transport route to deliver construction materials from Liverpool Dry will pass through Liverpool Bay SPA. It is anticipated that there will be only two journeys, one passing through at the beginning and one at the end, therefore bird disturbance should be kept to a minimum.
Dee Estuary SAC/SSSI	International	Due to the presence of Atlantic salt meadows which includes the sub feature saltmarsh, estuaries, mud flats and sandflats not covered by seawater at low tide which includes the sub feature intertidal communities. The presence of migratory fish species Atlantic salmon and sea and river lamprey and European Smelt.
River Dee and Bala Lake / SAC	International	No significant effects on the features of the Annex I habitats that are a primary reason for selection of this site are envisaged, as the habitat type supporting these communities does not occur at the location of the proposed Scheme. However, the SAC is considered to be of international / very high value due to the presence of migratory fish species Atlantic salmon and sea and river lamprey, and otter.
Habitats		
Running water	International	The River Dee is a priority habitat as well as being designated an SAC/SSSI.
Intertidal mudflats and sandflats	National	Although limited in its extent at the location of the Scheme, mudflats are a feature of the River Dee SSSI as well as being a priority habitat.
Saltmarsh	National	Although limited in its extent at the location of the Scheme, saltmarsh is a feature of the River Dee SSSI as well as being a priority habitat.
Fish Spawning and Nursery Grounds	International	The Dee Estuary is a spawning area for sprat (May – August). The Estuary is also a low intensity spawning area for cod (G. morhua), whiting (M. merlangus), mackerel (S.

VER	Value (sensitivity)	Justification
		scombrus), plaice (P. platessa) and sole (S. solea). A high intensity spawning ground for sand eel (Ammodytidae spp), It is also a nursery area for herring (C. harengus), whiting, plaice (low intensity) and sole (S. solea) (high intensity). The estuary is also a low intensity nursing ground for tope shark (G. galeus), thornback ray (R. clavata), spotted ray (R. montagui), monkfish (L. piscatorius), and sand eel, and a high intensity nursing ground for herring, cod and whiting. It is important to note that further upstream at the location of the proposed scheme and within the River Dee and Bala Lake SAC, the substrate comprises subtidal mud, which is unsuitable for spawning and nursery grounds of the fish species mentioned above.
Marine Species (Fauna)		
Marine Mammals	International	Marine mammals stranding records found at the mouth of the Dee estuary at Talacre included a fin whale (B. physalus) (sand bank on the River Dee), harbour porpoise (P. Phocoena) and grey seal (H. grypus). These records are very rare and have not been found in close proximity to the proposed Scheme.
Fish species protected under the Wildlife and Countryside Act (1981)	International	The Atlantic salmon, sea and river lamprey are features of interest of the SACs and regularly occur within the Dee at the location of the proposed Scheme. Fish numbers appear to be declining based on counts provided by NRW and conservation objectives, and so the value of this species group is of international importance.
Waterfowl and Waders	International	Overwintering birds: redshank, teal and oystercatcher, designated under the Dee Estuary SPA, were identified during the 2024-25 non-breeding bird surveys, it is important to note that the numbers of within the survey area did not reach or exceed significant thresholds of 1% or more of the population total of the designation. Lapwing and cormorant, listed under the assemblage qualification were also noted. Shelduck, black-tailed godwit and Dunlin, though not noted in the 2022/23 or 2024/25 surveys, were identified from the previous surveys completed in 2018/19 and 2020/21.

VER	Value (sensitivity)	Justification
		Breeding birds: The Scheme area supports several bird species of conservation concern. However, many species appeared to be in relatively lower abundance within the Scheme footprint when compared to the surrounding areas within, and beyond, the zone of influence extents. This is likely due to the availability of suitable foraging and breeding habitat
Other fish species	National	European smelt (Osmerus eperlanus) are a feature of both the River Dee and Dee Estuary SSSI. European smelt are of national significance due to their importance as an indicator species of water quality, meaning their presence or absence can reveal the health of the ecosystem. Furthermore, they also serve as a crucial food source for fish-eating birds and other fish, such as sea trout and sea bass.
Marine invertebrates	Local	The Dee Estuary supports a diverse array of marine invertebrates, particularly within its extensive intertidal mudflat and sandflat habitats. Mudflat and sandflat areas contain ragworm (H. diversicolor), with small areas of barnacles (S. balanoides and/or B. crenatus) and the common periwinkle (L. littorea) on cobbles at low water. The mud includes a wide band of light airy impoverished sand which contains low numbers of the amphipod shrimps Corophium sp. and Bathyporeia sp. The site is sheltered but subject to moderately strong tidal streams and reduced salinity. Polychaete worms (likely ragworm) were found under rubble south-west of the A494 bridge whilst surveying.
INNS	N/A	No INNS were identified during the 2025 intertidal walkover surveys. Chinese Mitten Crab (E. sinensis) was recorded within 1735 m from the Scheme in Wepre Brook.

16.7 Mitigation Measures Forming Part of the Scheme Design

16.7.1 Several mitigation measures (primary, secondary, and tertiary) have been considered as part of the Scheme design to reduce any potential environmental

effects. These measures are considered to be standard industry practice[63] for this type of development and further details of these are detailed in Chapter 2 (The Project) of this report and mitigation measures specific to the Marine Environment chapter are below.

Avoid

16.7.2 Primary mitigation measures to avoid adverse effects have been adopted as an intrinsic part of the design. Reasonable avoidance measures would be used to protect breeding and wintering waterbirds, migratory fish, and marine invertebrates.

16.7.3 Where protected species or their habitats would likely be affected, the works will be carried out in accordance with the methods detailed in the Outline Construction Environmental Management Plan (CEMP) (Appendix 18A), or as agreed with a qualified marine ecologist, subject to consents, licences (e.g. Marine Licence, HRA, WFD) and conditions within those licences. Reasonable avoidance measures would include:

a) Maintain protection of intertidal and marine habitats which are being retained.

b) Where possible, avoid in-river works during salmonid fish migration seasons (April-May).

c) Where possible, avoid in-river works during lamprey fish migration seasons (May-July).

d) Where possible, avoid piling works during breeding bird season (March-August).

e) Where possible, avoid any temporary in-river structures during construction and operation & maintenance phase, which may impact fish migrations.

16.7.4 The following mitigation measures have been agreed and will be adopted within method statements:

a) The installation of pile casings will be undertaken between 0800 – 1700hrs, with no work undertaken in 3hr period leading up to high tide at Chester weir

[63] iema-mitigation-in-eia-guidance-final.pdf

(as previously agreed with Marine Area Advice and Management Team to reduce risk of disturbance to migrating fish).

b) Boring within the pile casings minimises noise and removes risk of material loss as silt into the River Dee.

c) Concrete works will be carried out with containment to prevent loss of concrete to the River Dee.

d) Lighting for works will be switched off outside working hours, and security lighting minimised to avoid deterring fish movement and the passage of otters. Note – there is an existing and significant floodlight source at Scottish Power Energy Networks (SPEN) on the south-west bank of the that currently illuminates the river at night all year round.

16.7.5 If the above mitigation measures are not achievable, then in-river working would be restricted to between early March and November, to avoid overwintering bird season which is obviously a major constraint on construction operations that could potentially lead to significant risk of delays to the construction programme and that should be avoided.

Minimise/Mitigate

16.7.6 Secondary mitigation measures are defined as actions taken after the initial design stage to prevent, reduce, or offset residual environmental impacts that could not be avoided through primary mitigation[23]. These measures are often imposed through planning conditions or within the Environmental Statement, and require further activity to achieve their intended outcome, such as engineering controls or specific operational practices and are integral to the Scheme:

a) Site supervision during de-watering works within the Queensferry Drain Statutory Main River;

b) Piling activities will be undertaken only in daylight hours to provide suitable windows of opportunity for migratory fish species (i.e. Atlantic salmon, sea trout, river and sea lamprey) to pass through the River Dee undisturbed on their migratory routes, as agreed by NRW during consultation.

c) Soft-start procedure to be implemented prior to commencement of piling activities to allow suitable time for fish, marine mammals, waterbirds, and other mobile species to move away and avoid areas of increased noise levels, thereby largely reducing the risk of injury and/or stress to these species.

16.7.7 In previous consultations with NRW, it was mutually agreed that the 'in river' working using a jack-up barge or pontoons could be carried out at any time of the year subject to the following restrictions:

a) Working hours restricted to daylight hours, which would typically be Monday – Friday 07:00 to 19:00 in the summer months, and 07:00 to 17:00 in the winter.

b) In-river piling activity working hours would be limited to between 08:00 to 17:00, and no piling work to take place in the 3 hours leading up to high tide at Chester weir.

16.7.8 Tertiary mitigation measures include producing and adhering to an INNS Management Plan. This will detail how the risk of potential introduction and spread of INNS will be minimised and outline measures to ensure vessels comply with the International Maritime Organization (IMO) ballast water management guidelines[64]. It will consider the origin of vessels and contain standard housekeeping measures for such vessels as well as measures to be adopted in the event that a high alert species is recorded.

16.7.9 Furthermore, biosecurity measures designed to manage and control the spread of INNS would be a contractual requirement for construction and an outline is presented within the outline CEMP (Appendix 18A). In Summary, the following measures will be implemented, where possible:

a) Access and egress to the water body will be limited to a single point(s) in order to undertake 'in river'; and,

b) Anything that comes in contact with the water, including boots and equipment, will be carefully cleaned.

Compensate

16.7.10 Permanent loss of saltmarsh habitat from the narrow ribbon of riverbank at the location of the bridge will occur as a result of the construction and operation of the new bridge. Removal of the existing bridge will remove the shading effects on the habitat directly below the existing bridge, providing replacement habitat with post-monitoring and management conditions (for further details, please

[64] International Maritime Organization (IMO) ballast water management guidelines

refer to Section 16.13 of this chapter), as well as the restoration and enhancement at the Greenfield Marsh site downstream from the Scheme.

16.7.11 The Greenfield Marsh site was identified following consultation with NRW and Flintshire County Council (FCC) to establish possible priority locations for saltmarsh restoration. The proposals are to preserve and monitor the area for the saltmarsh to colonise naturally by removing the rock rubble of the old embankment, and if required to enhance the area species through some manual enrichment should the existing conditions change, while also preserving the area of greenspace as existing and without any detriment on the existing rights for the public to use the land for outdoor recreation. Furthermore, the Greenfield site is approximately four hectares in size, therefore it will mitigate any losses from the proposed Scheme plus create additional habitat (for further details, please refer to Section 16.13 of this chapter).

16.7.12 The study team have considered the feasibility of creating new saltmarsh adjacent to the new crossing (also highlighted by NRW in previous consultation on 26th May 2022) but concluded that the Greenfield Marsh site, downstream of the Scheme, offers better potential for improving the condition and extent of existing saltmarsh as mitigation for saltmarsh loss.

16.7.13 The site was identified following consultation with NRW and Flintshire County Council (FCC) to establish possible priority locations for saltmarsh creation. The proposals are to preserve and monitor the area for the saltmarsh to colonise naturally and if required to enhance the area species through some manual enrichment should the existing conditions change. Whilst also preserving the area of greenspace as existing and without any detriment on the existing rights for the public to use the land for outdoor recreation.

16.7.14 The area under the existing River Dee Bridge which is currently unvegetated, littoral mud, will be subject to a separate monitoring and management plan with the objective of eventually achieving floristic assemblages matching as like-for-like as possible to the existing saltmarsh habitat adjacent on both banks.

16.7.15 The habitat restoration goals of the currently shaded site within the Scheme area and the Greenfield Marsh site should be to facilitate the natural colonisation of saltmarsh species, as both the hydrological and sediment conditions conducive to saltmarsh development should be established during this period.

16.7.16 Management actions within the first year to facilitate these restoration objectives should include the removal of any debris to facilitate natural re-vegetation, the grading and stabilising of banks if needed to match the adjacent marsh elevation and the installation of sediment traps or coir rolls if erosion risk is deemed high, with a monitoring plan in place for five years post-construction, which will be detailed in an Environmental Monitoring and Management Plan (EMMP) at pre-construction stage (refer to Section 16.11 for further details).

16.8 Assessment of Land Take Effects

16.8.1 In this section, the potential effects of land take of the Scheme are identified as areas below mean high water spring (MHWS) and assessed, with and without mitigation measures, in order to determine the significance of residual effects.

16.8.2 With regards to the area of land take associated with the replacement bridge, removal of existing River Dee bridge and associated riverbank area, an area of intertidal habitat classified as saltmarsh on the northeastern bank of the River Dee will be affected by the construction of the replacement bridge. The overshadowing effect caused by the new bridge would have an adverse effect on the strip of existing saltmarsh habitat which will be directly beneath it.

16.8.3 The northeastern bank of the river beneath the existing bridge is a concrete revetment devoid of any vegetation. The existing bridge will be removed and the existing substrate will be adapted to encourage a natural recolonisation of saltmarsh habitat from the adjacent riverbanks. Additional post-monitoring and management will be required to ensure it re-establishes sufficiently (refer to Section 16.13 (Environmental Monitoring) of this chapter for further details).

16.8.4 The intertidal and subtidal habitats in this location are considered of national importance, the impact and effect are considered as ***moderate adverse*** and is

therefore ***significant***. With the inclusion of the compensation measures and bank design mitigation, the impact and effects are reduced to ***negligible*** and is therefore ***not significant.***

Statutory designated sites, associated habitats and species

16.8.5 There will be ***no significant effects*** upon the marine qualifying features of the Dee Estuary Ramsar, SPA, and SAC. The boundaries of these sites are located approximately 1km downstream from the proposed Scheme footprint; therefore, no habitats of these designations will be directly affected by land take and consequently, there will be no change to these sites as a result of land take, which means the effects are ***negligible*** and ***not significant***.

16.8.6 The designated sites which are crossed by the Scheme are the River Dee and Bala Lake SAC and River Dee SSSI. No significant effects on the Annex I habitats that are a primary reason for selection of the SAC, namely Water courses of plain to montane levels with the *R. fluitantis* and *Callitricho-Batrachion* vegetation, are envisaged, as the habitat type supporting these communities does not occur at the location of the Scheme. The SSSI includes intertidal mud and sandflats and saltmarsh which are habitats which would be directly affected by land take.

16.8.7 The land take during construction of the replacement bridge, removal of the existing bridge, and associated infrastructure, including access, the new shared use path and drainage outfall, would result in a loss of and disturbance to intertidal and saltmarsh habitat. The former occurs on the south bank where the saltmarsh consists predominantly of mud and on the north bank where more characteristic species of saltmarsh have been identified.

16.8.8 The Scheme also requires the construction of piers within the River Dee. A small area (approximately 42.4m^2) of subtidal mud and sand would therefore be replaced by concrete bridge foundations. For the removal of the existing bridge, the existing bridge abutments, decking and crossheads would be removed and landscaped.

16.8.9 As tidal rivers are a dynamic system, the effects of land take in terms of riverbed habitat, are hard to estimate. A Hydrodynamic and Sediment Transport Modelling report has been produced and is provided as an Appendix to Chapter 7 (Water Environment) (Appendix 7E, Volume 2; Document Reference 395318 MMD-00-XX-RP-Z-0000). The effects from construction processes are assessed in Section 16.9 and further information on the project is provided in Chapter 2 (The Project).

16.8.10 The River Dee and Bala Lake SAC is crossed by the Scheme; however, **no significant effects** on the Annex I habitats that are a primary reason for selection of the SAC are anticipated, as the habitat type (*Water courses of plain to montane levels with the R. fluitantis and Callitricho-Batrachion vegetation*) does not occur at the location of the Scheme.

16.8.11 In the absence of mitigation, land take impacts upon the River Dee SSSI (a receptor of National significance) and associated habitats are considered to be a ***moderate adverse effect***.

16.8.12 There would be no significant land take effects upon features of interest of the Dee Estuary Ramsar/SPA. None of the key areas identified within these sites which are used by the wetland birds would be lost. The boundary of these sites are located 1.0km downstream from the Scheme footprint so no habitats of these sites would be directly affected by land take.

16.8.13 The River Dee SSSI is also crossed by the Scheme. Primary features of the designation are intertidal mud, sandflat and saltmarsh of national importance therefore are of ***moderate*** magnitude and impact. These habitat types would be directly affected by land take, resulting in a direct permanent loss of habitat, which would be considered a ***moderate adverse effect***; however, with the inclusion of the compensation measures and bank design mitigation, the impact and effects are reduced to ***negligible*** and is therefore ***not significant*.**

16.8.14 The proposed land take during construction of the replacement bridge, demolition works associated with the existing bridge and associated infrastructure, including access and drainage outfall, would result in a loss of and disturbance to intertidal and saltmarsh habitat; therefore, an ***adverse***

effect is anticipated. This occurs on both the south bank and north bank where coastal saltmarsh vegetative communities are found.

16.8.15 Furthermore, the shading effects of the new replacement bridge will extend beyond the construction footprint, therefore an ***adverse effect*** is anticipated; however, this would be mitigated in the long term by the removal of the existing bridge which will no longer be shaded, and saltmarsh will likely establish with the presence of sunlight with source populations of saltmarsh species deriving from the adjacent saltmarsh habitat either side of both abutments. This can take a considerable amount of time, as colonisation of pioneer saltmarsh species and succession to a mature saltmarsh vegetation at this location is unknown, ranging from two to three years for initial colonisation to decades for an area of established saltmarsh[65]. This area of habitat will be included in an environmental monitoring and management plan (EMMP) following construction which should detail objectives and steps to be taken should the vegetative community not develop favourably (i.e. not achieve the characteristics or floristic assemblage notable of an Annex I saltmarsh habitat, namely Atlantic saltmarsh H1330). This may include active restoration measures—such as plug planting of saltmarsh species or the use of pre-established vegetation matting. This will contribute positively to net benefits for biodiversity (NBB).

16.8.16 The feature is national importance and the impact of land take on the Annex I saltmarsh habitat would result in a ***moderate*** impact and the overall effect is ***moderate adverse*** which is ***significant***. Taking account of the measures set out in Section 16.7, the impact and effect is reduced to ***negligible***, and the overall effect on which is ***not significant.***

16.8.17 The primary mitigation included in the Scheme for the loss of saltmarsh and intertidal habitats is that replacement habitat would be developed. If successful, it is considered that this will mitigate in some way for the areas lost as a result of land take and so the residual effects in 5+ years are considered to be a ***moderate beneficial effect***.

[65] JNCC (2003), Saltmarsh Review: An overview of coastal saltmarshes, their dynamic and sensitivity characteristics for conservation and management: *Report No. 334*; 58-60,

Fish

16.8.18 The Atlantic salmon, sea lamprey and river lamprey are features of interest of the SACs and European smelt are a feature of the SSSI. These species all migrate annually within the River Dee at the location of the Scheme.

16.8.19 The Scheme requires the construction of piers within the River Dee. A small area of subtidal mud and sand, amounting to approximately of 42.4m^2, would be replaced by concrete bridge foundations. The sensitivity of the migratory fish species is high, however, due to the very small amount of land take (42.2m^2) relative to the total area of the riverbed, the magnitude is low, therefore the overall effect is ***minor adverse*** and therefore ***not significant.*** The effects upon fish during construction and operation are assessed in Section 16.9 and Section 16.10, respectively***.***

Marine Benthic Invertebrates

16.8.20 The placement of new bridge piers within the River Dee will permanently remove the subtidal sand and mud habitat substrates which is the characteristic habitat for benthic species.

16.8.21 Subtidal mud habitat is found throughout the intertidal and subtidal zones of the Scheme area and not the qualifying feature of the SAC designation. The placement of the new bridge piles and the retention of the existing bridge piles result in an overall net loss of sub-tidal mud habitat; however, this will result in a ***minor adverse effect***, as the area of this habitat represents 0.006%[66] of the total area of the River Dee and Bala Lakes SAC intertidal and subtidal habitat area.

16.8.22 Furthermore, the habitat lost is also not within the boundary of the Dee Estuary SAC, which is located 1km from the proposed works; additionally, key benthic species rapidly recruit following disturbance, allowing for rapid colonisation. The

[66] Land take of 0.0042Ha of subtidal and intertidal habitat for bridge piers. Total River Dee and Bala Lake SAC area = 1271.32Ha (6% of the SAC is Tidal rivers, Estuaries, Mud flats, Sand flats, Lagoons (4%) and Salt marshes, Salt pastures, Salt steppes (2%) = 76.279 ha)
(0.0042/76.279)*100 = 0.006%.

impact of intertidal sand and mud habitat loss due to the new bridge piles is assessed as a ***minor adverse effect*** and therefore ***not significant***.

16.8.23 In the absence of mitigation, effects from land take and therefore a loss of available habitat for marine benthic invertebrates (a receptor of ***local importance***) and is considered to be a ***minor adverse effect***. With the secondary and tertiary mitigation in place, detailed in Section 16.7, the effect of land take on benthic invertebrates has been assessed and is considered to be ***negligible*** and ***not significant***.

16.8.24 The residual effects upon marine invertebrate species and their associated habitats during operation are considered to be ***negligible*** and ***not significant***

Breeding Waterbirds and Waders

16.8.25 Breeding birds would be affected by land take in the form of loss of suitable intertidal habitat including saltmarsh, mudflat and sand. As the proposed development will potentially require the removal or impact of banks, saltmarsh and intertidal mud and sand, there will likely be a small reduction of nesting and foraging habitats for breeding birds, in the short-term as a result of land take.

16.8.26 In the absence of mitigation, land take effects upon breeding birds are considered to be ***negligible.*** The sensitivity of the feature is high, however due to the small amount of land take, the magnitude on breeding birds is negligible, therefore the overall effect with mitigation in place is a ***slight adverse effect*** and ***not significant***. Works would be timed to avoid the removal of vegetation within the nesting bird season (March to September, inclusive) or checks by an ornithologist will be made prior to clearance. The Scheme would incorporate landscaping to provide suitable habitat for nesting and foraging. Furthermore, the removal of the existing bridge will enable the gradual growth of saltmarsh in the once shaded areas, and the compensation measure at the Greenfield site will create more saltmarsh habitat further downstream. The residual effect of land take on breeding birds is considered to be ***neutral*** and ***not significant.***

Wintering Waterbirds and Waders

16.8.27 The majority of roosting species located within the site were primarily identified as using the small, rocky bays which were located >150m away from the proposed bridge works, on either side (see Appendix 8B, Volume 3; Document Reference: 395318-RML-00-XX-RP-Y-8012). In addition, species identified were never noted as utilising the areas beneath the bridge specifically for roosting or feeding.

16.8.28 There were 40 priority listed overwintering species recorded during the non-breeding bird surveys however, none of which represent a significant proportion of the national populations (<1% of total wintering population). These species are not heavily reliant on the habitats offered within the Scheme area. Although the coastal bird assemblages within the site extent were frequently encountered, there was a much greater presence of bird species >1.50km east and west of the central area (existing A494 River Dee Bridge).

16.8.29 Overall, the Scheme is not anticipated to have a substantial impact on overwintering birds in terms of land take, given that the proposed areas subject to removal, both permanent and temporary, are already exposed to considerable disturbances due to their proximity to existing roads, public spaces, and cycle networks. Additionally, existing more suitable habitats are accessible in close proximity to the Scheme and would be left undisturbed.

16.8.30 In the absence of mitigation, land take effects upon wintering birds (**a receptor of district importance**) are considered to be a ***minor adverse impact*** and ***not significant***. With primary, secondary and tertiary mitigation in place, the effect of land take on wintering birds is considered to be ***negligible adverse impac***t and ***not significant***.

16.8.31 The residual effect to wintering birds in terms of land take is considered to be ***neutral.***

16.9 Assessment of Construction Effects

16.9.1 In this section, the potential effects of construction of the Scheme are identified and assessed, with and without mitigation measures, in order to determine the significance of residual effects.

16.9.2 The main construction activities associated with the Scheme include:

a) Utility diversions;
b) Removal of existing bridge deck and cross heads and site clearance;
c) Associated earthworks required for the designed highway alignment as well as for drainage, structures and landscaping works;
d) Construction of and diversion of drainage systems;
e) Construction of new structures including a new pumping station;
f) Construction of the new and improved sections of the carriageway;
g) Construction of new access roads;
h) Construction of new shared use pathways; and,
i) Temporary lighting requirements.

16.9.3 In summary, construction activities which may cause noise and vibration disturbance within the river include the following:

a) Construction of pontoon – intermittent and infrequent noise (up to 8 weeks)
b) Positioning and re-positioning and use of jack-up barge
c) Installation of steel tube pile casings into the riverbed (expected to take up to 2 days per pile)
d) Boring within the pile casings (1.5 days per pile)
e) Forming piles with reinforcement and concrete (expected to take up to 0.5 days per pile)
f) Pile cap construction (the formwork method is expected to take up to 8 weeks for each (worse-case scenario), the Caisson method is expected to take up to 2 weeks)

16.9.4 The outline construction activities are provided in Chapter 2 (The Project) and have been described in more detail in the Constructability Report (Doc Ref:

395318-MMD-00-XX-RP-Z-0034). The anticipated effects of construction of the Scheme are based on a 'worst case scenario'.

16.9.5 The construction programme is dependent on several key constraints such as the diversion of utilities and any seasonal limits for works in the River Dee that may be imposed by NRW. Advance works to establish construction compounds, access points and to divert utilities are likely to begin several months before commencement of the main works. The construction activities and programme could be subject to modification during both the detailed design and the construction phases. Detailed information on construction and programme is provided in Chapter 2 (The Project).

16.9.6 The likely impacts arising from construction include temporary effect on fish health due to increased siltation in the river and estuary causing clogging of gills, the accidental release of pollutants (e.g. fuel and/or coolant from construction machinery, runoff from the riverbank due to earthworks/clearance) into the water, and increased noise and vibration underwater causing disorientation of migratory fish species. Furthermore, temporary loss of benthic invertebrate habitat due to disturbance of the riverbed. It is important to note that the primary, secondary and tertiary mitigation measures detailed in Section 16.7 are a vital component of the Scheme.

16.9.7 Control of pollution during construction will be set out in a detailed CEMP. This will include best practice measures to prevent accidental spillage of chemicals during construction activities. An outline CEMP can be found in Appendix 18A, a detailed CEMP will be completed by the appointed principal contractor during pre-construction phase and will align with the measures set out within the outline CEMP included as part of this application.

Statutory designated sites, associated habitats and species

16.9.8 There would be no direct construction-stage effects upon features of interest of the Dee Estuary Ramsar, SPA and SAC. The boundary of these sites is located 1.0km downstream from the Scheme.

16.9.9 There may be indirect effects in the absence of mitigation, in particular on saltmarsh and intertidal habitats and features of interest including birds, river and sea lamprey and European smelt as a result of works within the River Dee to construct the bridge, and to remove the existing bridge. Indirect impacts may include smothering due to sedimentation from piling activities and potentially resuspension and release of dissolved contaminants that may be trapped in the sediments, increased water turbidity, noise and air pollution and also the potential introduction and spread of marine invasive non-native species.

16.9.10 A HRA Screening and Appropriate Assessment would be carried out to assess the effects of the Scheme on the SAC, SPA, and Ramsar sites (in progress). As the River Dee is tidally influenced, all in-river operations and construction would be subject to the application of a Marine Licence to NRW, ensuring that operations are conducted in an environmentally responsible and legally compliant manner.

Fish

16.9.11 To construct the proposed bridge, a piling rig mounted on a temporary platform or on a ‘jack-up’ barge would be used to drive thin, steel tubes into the riverbed. When the tubes reach the required depth, bored piles will be constructed by positioning an auger inside the steel tube. This way the disturbance of the silt and vibration at the riverbed will be kept to a minimum and restricted only to the steel tube-driving operations, thus reducing the quantity of suspended particulates and noise within the water course which may indirectly affect fish. This construction methodology is classified as a primary mitigation measure of the Scheme.

16.9.12 Temporary construction impacts on migratory fish may occur from accidental spillages of chemicals and substances, increased sediment mobilisation, increased vibration / noise during in-channel works conducted in the migration season and temporary lighting.

16.9.13 These activities can lead to behavioural effects such as avoidance of the noise source and interruption of migratory routes. The impact of underwater noise

produced during pile driving operations has not been modelled, the assessment of the effects on migratory fish species is based on existing literature and professional judgement.

16.9.14 It is anticipated that the in-river piling works could take up to 12 months, depending on the contractor's detailed construction methodology and programme (see Appendix 18A). Noise and silt disturbance would arise from inserting the steel casing tubes into the riverbed to a depth sufficient to achieve stability and a seal to minimise water ingress and contain disturbed silts. The tubes would be oscillated or driven in with vibration. A rotary bore within the steel tubes would remove riverbed silt and underlying glacial till deposits to the full pile depth required. Other associated noise or silt disturbance may arise from the installation of the temporary sheet piles in the riverbank, which are to maintain flood bank level of integrity during construction.

16.9.15 A modelling study has been conducted to assess the impact of underwater noise produced during piling within the river on migratory fish. This is reported within Chapter 16, Marine Environment.

16.9.16 Behavioural impacts in fish following their exposure to underwater noise relate to the way in which they hear and how they may subsequently respond to the sound. Variation in the anatomy and physiology of the ears and associated structures in fish is extensive, indicating that different species detect sound in different ways[67].

16.9.17 Excessive fine sediment, in suspension or deposited, can have damaging impacts on all life stages of fish, particularly salmonids. The effect on ecosystems will, however, depend on several key factors, including the concentration of fine sediment in suspension, the duration of exposure to fine sediment and the sediment chemical composition and particle size[68].

[67] Popper, Arthur N., and Richard R. Fay. "Sound detection and processing by fish: Critical review and major research questions (part 2 of 2)." Brain, behaviour and evolution 41.1 (1993): 26-38.
[68] Bilotta, Gary S., and Richard E. Brazier. "Understanding the influence of suspended solids on water quality and aquatic biota." Water research 42.12 (2008): 2849-2861.

16.9.18 Pollution could have a detrimental effect on salmonids migrating to spawning grounds further upstream. Turbidity of water, particularly if the turbidity is caused in part by organic compounds, can increase the oxygen deficit and this can play a part in making the river unsuitable for migrating fish.

16.9.19 Sea and River Lamprey are adversely affected by pollution in the lower reaches of rivers and cannot migrate through heavily polluted water. Populations can be eliminated from rivers with high-quality habitat in the upper stretches due to pollution incidents further downstream[69].

16.9.20 The noise and vibration associated with piling to form the foundations for the replacement bridge has a ***moderate*** impact and will have a ***moderate adverse effect*** on salmonid and lamprey species (high sensitivity), which is ***significant***. With secondary and tertiary mitigation measures implemented in the Scheme and agreed with NRW, the in-river piling works would be restricted to daylight hours only (8am to 5pm) with a soft-start approach to minimise the risk of disturbance to migrating fish, the effect of noise and vibration disturbance on migratory fish (very high sensitivity) is ***minor adverse impac***t, and therefore ***not significant***.

16.9.21 Temporary lighting during the construction period, may also disturb migratory fish. Artificial lighting may disorientate migrating fish or deter them for fear of predation, indirectly affecting migration.

16.9.22 In the absence of mitigation, temporary lighting effects upon migratory fish within the River Dee (a receptor of ***international importance and therefore very high sensitivity***) the impact and effect are considered to be ***moderate adverse,*** which is ***significant***. With the secondary and tertiary mitigation in place, the effect of temporary lighting disturbance on migratory fish is considered to be a ***minor impact*** and ***not significant***.

16.9.23 The effect of construction activities on European smelt (a receptor of ***national importance***) is considered to be ***moderate adverse*** *and* ***significant***. With the

[69] Maitland, P. S. "Ecology of the River, Brook and Sea Lamprey–Conserving Natura 2000 Rivers." Ecology series 5 (2003).

secondary and tertiary mitigation in place, the effect of temporary lighting disturbance on migratory fish is considered to be a ***minor impact*** and ***not significant***.

Marine Benthic Invertebrates

16.9.24 In the absence of mitigation, construction effects, such as sediment disturbance and risk of pollution from construction machinery (e.g. fuel, lubricants and coolants) entering the water and sediment, on marine benthic invertebrates (a receptor of ***local importance***) are considered to be a ***minor adverse effect***. With the secondary and tertiary mitigation in place, the effect of disturbance from construction on benthic invertebrates has been assessed and is considered to be ***negligible adverse impac***t and ***not significant***.

16.9.25 Although not significant, the application of standard industry practices means the magnitude of impact would be reduced and the residual effect is reduced to ***negligible*** which remains ***not significant.***

Breeding waterbirds and waders

16.9.26 Designated breeding bird species supported by the Dee Estuary Ramsar/SPA (little egret, redshank, teal, and oystercatcher) did not exceed significant thresholds of 1% or more of the designated site population within the survey area. Though the Scheme survey area and footprint appears to support a moderate number of species (>21) during the breeding season. Saltmarsh and mudflats during low tide provide valuable foraging habitats, and saltmarsh habitat during high tide provides a vital high tide roost area for breeding birds.

16.9.27 Of the species identified using the surveyed areas in the breeding season, redshank and shelduck are the most sensitive to noise disturbance, though these species were recorded in low numbers (shelduck peak count in the breeding season was 2, redshank peak count in the breeding season was 3) and were not confirmed as breeding within the Scheme survey area.

16.9.28 In the absence of mitigation, effects of construction activities upon breeding waterbirds, which are of international importance and high sensitivity, are

considered to be a ***minor adverse effect*** due to their low numbers, and ***not significant***.

16.9.29 To reduce disturbance and displacement during the construction and demolition phase, mitigation measures include quieter operating plant and machinery are used. In addition, it is also advised that acoustic and visual bunds are placed to alleviate visual and noise disturbance to the foraging and (or) commuting species.

16.9.30 With the adoption of Reasonable Avoidance Measures as set out within the bird survey reports and Chapter 8 of this report (Terrestrial Biodiversity) and the potential to restore some of the habitat lost, the residual impact upon local bird assemblages is considered to be ***negligible*** and ***not significant.***

16.9.31 The potential construction impacts of the Scheme on breeding birds may include temporary loss and fragmentation of foraging habitat; and increased levels of disturbance resulting from noise and light if not mitigated for appropriately. This or could result in a reduction in species richness and/or abundance; displacement of birds from foraging sites. This would result in a minor adverse effect and therefore not significant.

16.9.32 Providing the mitigation recommended is followed, the residual effect to wintering waterbirds and waders in terms of construction effects is considered to result in a ***minor adverse effect*** which is ***not significant***.

Wintering waterbirds and waders

16.9.33 The wintering qualifying bird species for the designated site; redshank, shelduck, oystercatcher and curlew, appeared to use the areas surveyed, however these were recorded in relatively small numbers and did not represent a significant proportion of the Dee Estuary SPA or Ramsar populations (<1% of total wintering population). The abovementioned species are not heavily reliant on the habitats offered within the Scheme area.

16.9.34 Although the coastal bird assemblages within the site extent were frequently encountered, there was a much greater presence of bird species >1.50km east

and west of the central area (A494 river Dee crossing). This could be due to the current high disturbance within the site extent including heavy traffic on the existing bridge crossing above the river, pedestrians and regular agricultural practices within the fields surrounding the site (observe from a pre-determined transect route).

16.9.35 Further to this, there were several occasions where local dog walkers did pass through the site, which caused some disturbance, however this was only temporary. The birds returned back to their original roosting and/or feeding location; the medium, rocky bays exposed only during low to mid tide located >200m from the centre of the proposed works.

16.9.36 Based on the tide toolbox[70] generic waterbird responses to disturbance from a range of activities including construction work have been collated and summarised over time. Table 16-10 provides the type and level of disturbance. When reviewing this, one needs to consider the existing background noise at the site as well as its use by and proximity to public rights of way (PRoW) and other roads/cycle routes.

Table 16-10 General waterbird disturbance levels stimuli

Activity	Value (sensitivity)	Site context
Personnel on mudflat	High	During construction and demolition, activity within and on the intertidal mudflats would increase.
Intermittent plant and personnel on crest	High to moderate	During construction and demolition, activity within and on the intertidal mudflats would increase
Irregular piling noise (above 70db)	High to moderate	Sheet piling needed to stabilise banks during demolition. Noise associated with pile driving.
Regular piling noise (above 70db)	Moderate	As above

[70] Available at TIDE toolbox - TIDE tools [Accessed 09/06/2025]

Activity	Value (sensitivity)	Site context
Irregular noise (50-70db)	Moderate	Increased and irregular noise levels during demolition and construction.
Regular noise	Moderate to low	For example, existing road traffic which would continue
Occasional movement of crane	Moderate to low	Required to install the bridge from the jack-up barge, may also be temporary visual effects
Noise below 50db	Low	What are the existing noise levels, get from baseline noise report
Activity in land	Low	Construction activities in land, i.e. demolition of existing properties and construction of new road section, footpaths etc.

(Source: TIDE toolbox)

16.9.37 Of the over wintering qualifying species for the designated site identified using the surveyed areas, redshank and shelduck are the most sensitive to noise disturbance.

16.9.38 In the absence of mitigation, effects upon wintering waterbirds are considered to be a ***slight adverse effect***.

16.9.39 To reduce disturbance and displacement during the construction and demolition phase, it is advised that quieter operating plant and machinery are used. Where unavoidable, anticipated noisier construction activities should not be completed during three hours leading up to high tide, in order for bird species to utilise the banks during low tide undisturbed, in order to both commute and/or forage. In addition, it is also advised that acoustic and visual bunds are placed to alleviate visual and noise disturbance to the foraging and (or) commuting species.

16.9.40 With the adoption of Reasonable Avoidance Measures as set out within the bird survey reports and the Terrestrial Biodiversity Chapter and the potential to restore some of the habitat lost, the residual impact upon local bird assemblages is considered to be ***neutral.***

16.9.41 The potential construction impacts of the Scheme on non-breeding birds may include loss and fragmentation of foraging habitat; and increased levels of disturbance resulting from noise and light if not mitigated for appropriately. This would result in a reduction in species richness and/or abundance; displacement of birds from foraging sites; and a reduction in overwinter survival. This would result in a ***minor adverse effect***.

16.9.42 To reduce disturbance and displacement during the constructional phase, it is advised that quieter operating plant and machinery are used during works to the bridge area. Where unavoidable, anticipated noisier construction activities should be completed during three hours either side of high tide in order for species to utilise the banks during low tide in order to both commute and/or forage. In addition, it is also advised that acoustic and visual bunds are placed to alleviate visual and noise disturbance to the foraging and/or commuting species listed above.

16.9.43 To mitigate disturbances and the displacement of overwintering species during the construction phase, it is recommended to implement acoustic and visual barriers. These measures would help minimize both noise and visual disturbances, ensuring a more favourable environment for the aforementioned bird species.

16.9.44 Providing the mitigation recommended is followed, the residual effect to wintering waterbirds and waders in terms of construction effects is considered to result in a ***temporary minor adverse effect*** which is ***not significant***.

16.10 Assessment of Operational Effects

16.10.1 In this section the potential effects of operation of the Scheme, once open to traffic, are identified and assessed, with and without mitigation, in order to determine the significance of residual effects.

16.10.2 Effects from the operation of the road include potential increase in public access and vehicles, permanent highway lighting, and hydromorphological changes including changes to flow, velocity or sediment dynamics within the

River Dee. It is important to note that the mitigation measures detailed in Section 16.7 are a vital component of the Scheme.

Statutory designated sites, associated habitats and species

16.10.3 There will be no direct operational effects upon features of interest of the Dee Estuary Ramsar, SPA and SAC. None of the key areas identified within these sites will be subject to any further effects during the operation of the road as the boundary of these sites is located 1.0km downstream from the Scheme footprint. As the number of lanes on the new Bridge are staying the same as the existing (two lanes), no increase of contaminants in surface water runoff from the road due to higher volume of traffic is anticipated. An analysis of the long-term impacts of surface water run-off into the River Dee has been provided in Chapter 7 (Water Environment), this concluded a slight (beneficial) permanent effect given the provision of a new swale channel and vegetation lined open channel diversion of the Queensferry Drain and increase in swale capacity.

16.10.4 It has been concluded that the realignment of the A494 River Dee Bridge would not change the overall air quality impact on designated habitats (Chapter 11: Air Quality). The A494 River Dee Bridge is not expected to change the quantity of road traffic emissions or their impact on intertidal ecological receptors but rather relocate these impacts approximately 40m south-east where habitat critical loads are similar; therefore, it has been concluded that the magnitude of emissions are expected to be the same and therefore no significant effects on air quality are anticipated.

16.10.5 The designated sites which are crossed by the Scheme are the River Dee and Bala Lake SAC and River Dee SSSI. No significant effects on the Annex I habitats are anticipated, due to not being present in the vicinity of the Scheme footprint, so no pathway and therefore no effect. The SSSI includes intertidal mud, sandflats and saltmarsh which are habitats that could be affected by the shading effects of the replacement bridge, in particular to the north bank which contain abundant sea purslane, a typical species of Atlantic salt meadow. The shading effects of the replacement bridge will be mitigated by the removal of

the existing bridge and the habitat compensation at the Greenfield site downstream of the Scheme.

16.10.6 The hydrodynamic and sediment transport modelling study (Appendix 7E, Volume 2) concludes that the construction of the replacement bridge will not significantly alter water levels but may lead to localised changes in current speeds and flow patterns, which in turn, may cause localised increases in water turbidity and new areas of erosion or sediment deposition. As the channel is already tidal, heavily modified and turbid, the predicted changes in water turbidity are not expected to be significant. The original bridge piles are being left in-situ, as such the presence of additional bridge piles from construction of the new bridge increases eddy formation and slightly modifies current speeds, though these changes are small-scale and do not result in large-scale hydrodynamic impacts.

16.10.7 The hydrodynamic and sediment transport modelling study concluded that although localised areas of erosion and deposition occur, particularly near the bridge piles, this would not significantly disrupt overall sediment dynamics. Overall, while the new bridge influences localised flow conditions, its broader impact on tidal regime and sediment transport remains limited within this naturally variable tidal channel and so no significant operational effects are predicted.

16.10.8 In the absence of mitigation, the impact level is considered to be ***minor adverse***. Given the sensitivity of designated sites is very high, resulting operational effects upon the designated sites and associated habitats (a receptor of international importance) are of a ***moderate adverse effect (significant)***.

16.10.9 Given the primary mitigation included in the Scheme for the loss of saltmarsh and intertidal habitats outlined in Section 16.7, operational effects upon saltmarsh and intertidal habitats are considered to be ***negligible*** and ***not significant.*** The shading effects of the replacement bridge will be mitigated for in the long-term (1-5 years) by the removal of the existing bridge and habitat compensation at the Greenfield site downstream from the Scheme.

16.10.10 The residual effects upon the designated sites and associated habitats during operation are ***neutral*** and ***not significant***.

Fish

16.10.11 The potential effect of loss and/or disturbance of fish habitats, including spawning and nursery habitats, has been considered in relation to the permanent loss of benthic intertidal and subtidal habitat due to the installation of new bridge piers and keeping the old bridge piers in place. The most sensitive species are likely to be demersal species (e.g. flounder, sole, and plaice) and elasmobranchs (e.g. tope shark and rays); however, such species are not expected so far upstream within the Scheme area and would more likely be found in the mouth of the Dee Estuary therefore are not considered to be at risk. Similarly, whilst of very high conservation value and sensitivity, migratory fish species are unlikely to be sensitive to this impact due to being highly mobile, their ability to avoid the impacted area and their unlikely requirement to rely on the small habitat loss that will be removed by the Scheme for foraging; therefore the sensitivity to this impact is assessed as ***negligible,*** with a ***minor adverse effect*** and therefore ***not significant***.

16.10.12 The permanent loss or disturbance of benthic habitat within the River Dee could lead to a localised decrease in infaunal and epibenthic marine invertebrates which in turn reduces food availability for fish, which could have consequences for the local abundance of fish species following the impact; however, the footprint is very small and localised, with a large area of suitable surrounding habitat, therefore the sensitivity to this impact is assessed as ***negligible,*** with a ***minor adverse effect*** and therefore ***not significant***.

16.10.13 The subtidal mud habitat which will be lost at the proposed bridge footprint location is not suitable fish spawning substrate, therefore the sensitivity to this impact is assessed as ***negligible,*** with a ***minor adverse effect*** and therefore ***not significant***.

16.10.14 The impact of additional light on fish migratory routes is considered within the Environmental Lighting Impact Assessment (ELIA) for the Scheme (Doc ref:

395318-MMD-00-XX-RP-E-0009). This considered two receptor locations within the immediate vicinity of the existing bridge and adjacent to the River Dee (E03 and E04), with another receptor location, H02, further downstream by the existing Queensferry Bridge (also known as Jubilee Lift Bridge), which is approximately 150m northwest of the existing A494 bridge.

16.10.15 Receptor location E03 is situated along a proposed active travel route on the southwestern bank of the river and receptor location E04 is situated along the existing national cycle route 568 on the northeastern bank of the river, which is to be reprofiled and retained as part of the Scheme. Receptor location H02 is a metal bridge with a two-way single lane carriageway which is illuminated by several floodlights mounted on the structure at high tilt angles producing a white coloured light, emitting a bright white light, with noticeable spill onto the river surface.

16.10.16 The proposed operational illumination levels for receptor location E03 with no de-rating maintenance factor applied, indicates a predicted level of change assessed as ***major adverse*** on biodiversity (e.g. migratory fish), while for receptor location E04, indicates a predicted level of change assessed as ***minor adverse*** and for H02, the predicted level of change assessed as ***negligible/not significant*.**

16.10.17 Mitigation measures have been recommended for this location (E03) which will be part of the Scheme's commitments, such as lighting on the central area of the road (with forward facing integral light shields), rather than on the outer areas of the bridge to reduce light spillage, also lower colour temperatures and rear light shields on the proposed lighting for the active travel routes under the bridge; however, in summary, the ELIA concluded that location E03 is currently a dark, unlit area that will be lit in the future.

16.10.18 Taking the findings of the ELIA into account when assessing the impact of light disturbance of the Scheme on migratory fish species (very high sensitivity); even though the light from the Scheme during operation will be higher than the current baseline conditions, with mitigation measures in place to keep light spillage onto the river to a minimum, and considering that the much higher light

spillage from Queensferry Bridge (H02) downstream of the Scheme has not created a barrier for migratory fish, potentially due to the high turbidity of the water which is known to restrict light penetration[71], the significance of effect is considered as ***minor adverse*** and **not significant**.

Marine Benthic Invertebrates

16.10.19 The placement of new bridge piers within the River Dee will permanently remove a small area of intertidal and subtidal sand and mud habitat, which is the characteristic habitat for marine benthic species.

16.10.20 Benthic species are known to rapidly recruit following disturbance, allowing for rapid colonisation. Furthermore, the area of sub-tidal mud habitat of the River Dee and Dee Estuary is very large, with sufficient space for quick re-establishment of benthic species.

16.10.21 The residual effects upon marine benthic invertebrate species which are of local importance and negligible sensitivity during operation are considered to be ***minor adverse*** and ***not significant***.

Breeding waterbirds and waders

16.10.22 The lighting plan indicates lighting along the active travel route on the south-western side of the new bridge. The proposed luminaires will support the Active Travel Route connection to Station Road and are required for health and safety/personal security. These are directional LED luminaires mounted on 6-metre-high columns, with low kilolumen (klm) output and a correlated colour temperature of 3000K. The lighting changes at viewpoints E03 and E04 are expected to have a minor adverse level of change during the construction phase, with all other receptor locations seeing no/negligible change. As such it is anticipated there will be a ***minor adverse effect*** on breeding bird nesting

[71] R.J. Davies-Colley, D.G. Smith (2001). Turbidity, suspended sediment, and water clarity: a review. The *Journal of the American Water Resources Association* **37**(5): pp. 1085-1101. Available at: https://www.researchgate.net/publication/229559740_Turbidity_Suspended_Sediment_and_Water_Clarity_A_Review

areas during breeding bird season, where light spills onto the suitable breeding habitat from receptor sites E03 and E04.

Wintering waterbirds and waders

16.10.23 The potential operational impacts of the Scheme on non-breeding birds may include increased levels of disturbance resulting from noise and light if not mitigated for appropriately. This would result in a reduction in species richness and/or abundance; displacement of birds from foraging sites; and a reduction in overwinter survival.

16.10.24 The lighting plan indicates lighting along the active travel route on the south-western side of the new bridge. The proposed luminaires are described in 16.10.22. The existing bridge and areas under the existing bridge are currently unlit so there is a potential for a ***moderate adverse effect*** on bird roosting areas where light spills onto the River Dee and the nearby intertidal areas/riverside banks close to receptor sites E03 and E04. Further afield, the proposed lighting scheme is expected to have **negligible effect** to wintering waterbirds and waders as predicted levels of lighting change are considered to be **negligible** and therefore ***not significant***.

16.10.25 To reduce disturbance, displacement, and to reduce road mortality during the operational phase, the planting of treelines and/or hedgerows has been added to the design, to act as natural visual and sound barriers surrounding the widening of the A494 road, particularly alongside the westbound carriageway as the current tree and shrub line is likely to be lost. In addition to this, these natural barriers will also compensate and/or create new habitats for wintering waterbirds and waders, and elevate bird flight paths which will aid the reduction of road mortality (EMPs; Chapter 2, Vol. 2; Figures 2.1 to 2.4).

16.10.26 Providing the mitigation recommended is followed, the residual effect to wintering waterbirds and waders in terms of operation effects is considered to result in a ***temporary minor adverse effect*** and ***not significant.***

16.11 Environmental Monitoring

16.11.1 The purpose of monitoring is to:

a) ensure measures are delivered which are envisaged to avoid, prevent or reduce and, if possible, offset significant adverse effects on the environment;

b) build data on the effectiveness of design and mitigation measures thereby driving improvement in environmental performance for future projects;

c) satisfy licence / permit /draft order requirements (where applicable); and

d) identify remedial action as a consequence of underperformance or failure of mitigation.

16.11.2 Monitoring would be undertaken both during the construction and the operation of the Scheme to confirm the effectiveness of mitigation measures and, if necessary, to inform the need for any changes.

Environmental Monitoring during construction

16.11.3 The Contractor would be required to monitor the site during construction to ensure that all construction-phase mitigation is in place.

16.11.4 Monitoring of watercourses at risk from pollution would be carried out at pre-construction and during the construction phase. This would comprise visual assessments for oil and silt, supplemented by turbidity monitoring using portable field indicator equipment, where necessary by sampling at locations up- and downstream of the works (and tested as appropriate for suspended solids, pH changes and hydrocarbons). Monitoring requirements would be discussed and agreed with NRW. Further information is provided in Chapter 7 (Water Quality) and Chapter 19 (Conclusions).

Environmental Monitoring during operation (0 to 5 years, post-construction)

16.11.5 On completion of the construction phase, there would be a five-year aftercare period at a minimum to ensure the establishment of the landscape and ecological elements of the Scheme. The environmental requirements for this period would be implemented through an Environmental, Landscape and

Ecology Aftercare Plan as set out in Chapter 18 (Environmental Management) of this ES.

16.11.6 The foreshore area of Greenfield Marsh, near Walwen, contains areas of saltmarsh habitat of variable condition including patches of rubble left as vestiges from an old landfill. The proposals are to remove debris, preserve and monitor the area for the saltmarsh to colonise naturally and if required, to enhance the area species through some manual enrichment, should the existing conditions change. This will increase the extent of the saltmarsh habitat, and removing debris will enhance its current condition. This is considered proportionate to that lost as a result of the Scheme. Welsh Government would collaborate with Flintshire County Council (FCC) and Natural Resources Wales (NRW) to progress with these proposals should the Scheme be consented. Post-monitoring of the saltmarsh would be carried out for the first 5 years, as specified by NRW and FCC, with a specific post-debris removal management and monitoring plan implemented.

16.11.7 The overall aim should be to increase the extent of the saltmarsh across the area of mudflat post-debris removal. The monitoring objective of the monitoring and management plan in years 1-5 should be to assess the progress of the area of mudflat in naturally re-colonising towards that of an SM13a NVC community which is currently present on site according to the baseline survey. This community should be considered as the target end habitat as it closely resembles Annex I Atlantic salt meadows habitat and thus reflects a high biodiversity value. This community is already present on-site though its extent is likely hindered by the piles of rubble.

16.11.8 A target total percentage vegetative cover of the mudflat and percentage SM13a cover should be agreed upon (≥70% cover by year 5; ≥80% SM13a by year 5 for example). The cover of vegetation is recommended to be monitored quarterly for years 1-5 post-rubble removal, through fixed quadrats and aerial imagery surveys. Species composition should also be monitored annually by means of further NVC surveys. Should low natural colonisation occur (e.g. <30% by year 2) then assisted planting using plug plants, matting or seed should be considered. Other parameters to be monitored should include the

elevation change and hydrology. The elevation change should be monitored annually and is recommended to aim to be within ±5 cm of the adjacent SM13a community. The hydrology should include regular tidal inundation logs which should aim to be regular enough to support an SM13a community.

16.11.9 The areas situated under the current bridge which are currently unvegetated, littoral mud should be subject to a separate monitoring and management plan with the objective of eventually achieving floristic assemblages matching as like-for-like as possible to the saltmarsh habitat adjacent on both banks (assuming the National Vegetation Classification (NVC) survey undertaken by Mott MacDonald ecologists in July 2025 is representative of the adjacent saltmarsh). In the short-term (0-5 year post-bridge removal), the restoration goals of the site should be to facilitate the natural colonisation of saltmarsh species. Through this, at least 50–70% cover of target saltmarsh species should be achieved (those recorded during the NVC survey). Both the hydrological and sediment conditions conducive to saltmarsh development should be established during this period. Management actions for years 0-1 to facilitate these objectives should include the removal of any debris to facilitate natural re-vegetation, the grading and stabilising of banks if needed to match the adjacent marsh elevation and the installation of sediment traps or coir rolls if erosion risk is deemed high. In the long term (5+ years post-bridge removal) the objective should be to achieve and maintain habitats with a floristic composition parity with adjacent saltmarsh, representing a stable saltmarsh community which can withstand tidal and climatic variations. These habitats should be maintained with minimal invasive species present. Management actions during years 1-5 are recommended to include passive restoration where natural colonisation takes place. Monitoring may include quarterly vegetation surveys as well as soil salinity and elevation checks. If colonisation is <30% by year 2, assisted planting using plug plants, matting or seed from adjacent marsh should be considered. If invasive species appear, manual removal or targeted control should be initiated.

16.11.10 Further details of ecological post-monitoring plans will be documented in an Environmental Monitoring and Management Plan (EMMP) at pre-construction

stage and approved prior to commencement of works by the Design & Build contractor (appointed contractor, to be confirmed).

Post-Construction Environmental Monitoring Documentation

16.11.11 The results of monitoring shall be reported through updates in the EMMP during construction and handover phases.

16.11.12 The results and evaluation of monitoring shall be reported to the Overseeing Organisation and/or competent authority. Any proposals for remedial action shall be discussed and agreed with the Overseeing Organisation and/or competent authority on a case-by-case basis.

16.11.13 Any development licences and/or consents would be subject to their own licence reporting processes and licence return forms.

16.12 Assessment of Cumulative Effects

16.12.1 The cumulative effect of the Scheme has been considered with other plans or projects within a pre-defined geographical area as part of a cumulative effects assessment (CEA). Existing nearby developments that are built and operational at the time of assessment have been considered as part of the baseline.

16.12.2 The cumulative effects of the Scheme with other projects in the surrounding area are addressed in Chapter 17 (Cumulative Effects and Inter-relationships). It was concluded that the potential for any of the identified projects to generate cumulative effects with the Scheme would not be significant within the Zone of Influence. Other developments are sufficiently distant to or do not occur at the same time as the Scheme, or are of a sufficiently minor scale, and so do not represent any significant cumulative effects as a result of this Scheme in combination with other plans and projects.

16.12.3 Cumulative effects on sites within the UK National Sites Network are addressed in the HRA Screening and Appropriate Assessment which has been completed in parallel to the ES.

Inter-relationships

16.12.4 In identifying and assessing the likely impacts of the Scheme on the marine environment, the inter-relationships with the environmental impacts identified in other ES chapters have been considered. These are:

- Chapter 6: Geology and Soils – Discharge of contaminated or sediment laden groundwater to the River Dee following dewatering of excavations or foundations works. Contamination of soils (including intertidal habitats), groundwater and surface water from accidental spills and leaks relating to construction plant and fuels / oils. Several measures have been highlighted within this chapter as being suitable for mitigating the potential effects. These include the protection of soil structure and quality, the protection of controlled water from both general site works, and foundation works, and to manage contamination risks.

- Chapter 7: Road Drainage and Water Environment – This chapter focused on the construction and operational effects of the proposed Scheme on the water quality on the River Dee and associated habitats and species, including those listed as features of interest of the designated sites. A WFD assessment has been carried out to support the Marine Environment chapter. The WFD concluded that the proposed Scheme would be unlikely to have an impact on the WFD status of the River Dee, assuming that there were no long-term impacts on sedimentation and river flow in line with the conclusions of the Hydrodynamic and sediment transport modelling study (Appendix 7E, Volume 2).

- Chapter 8: Terrestrial Biodiversity - This chapter relates to the terrestrial ecological features and provides an assessment of likely significant effects on receptors identified as being at risk of the construction, operation and maintenance of the Scheme. There are close inter-relationships between this and the Marine Environment chapter, in particular for terrestrial and intertidal habitats, and coastal and terrestrial ornithology.

- Chapter 9: Landscape & Visual – The Environmental Masterplans (EMPs) and proposed landscape works (Chapter 2, Vol. 2; Figures 2.1 to 2.4) have been informed by the potential ecological effects of the Scheme on the Valued Ecological

Receptors. Net gains and losses in intertidal habitat have been assessed, and sensitive landscaping proposed to create / maintain connectivity and enhance existing ecology habitat with biodiversity value.

- Chapter 12: Noise and Vibration – The noise and vibration effects upon ecological receptors has been informed by assessments carried out in this Chapter. This includes the assessment of construction vibration, including piling within the River Dee. The vibration levels indicate that human receptors located approximately 30m or less from vibratory piling operations may experience an adverse effect due to piling activities. The approach for controlling construction noise will be to reduce source levels where possible and sensitive timing of in-river works. In some circumstances it may be preferable to use plant which generates a higher level of noise if this significantly reduces the construction time.

- Chapter 13: Materials and Waste - During the construction and operational phase, materials and waste would be present close to the road drainage system linked to the River Dee, with potential for run off which could have ecological impacts on species and habitats and on water quality. Working methods to manage and limit these risks are set out in Chapter 19 Environmental Management.

- Chapter 15: Climate – An increase in winter precipitation and frequency of extreme rainfall events as a result of climate change, may increase risk of contaminants entering the marine environment, which could in turn have ecological impacts on species and habitats and on water quality. To mitigate this, the Scheme includes a comprehensive flood risk and drainage design, which is in line with DMRB guidance and has been modelled and designed with consideration of climate change allowances and use of a Sustainable Drainage System (SuDS).

16.13 Residual Effects

16.13.1 The Scheme includes works within and adjacent to sites which form part of the National Site Network and other-designated sites and would affect subtidal and intertidal habitats which support protected and notable species including marine invertebrates, waterbirds and waders, and several fish species.

16.13.2 This Chapter has assessed the effects of the Scheme on VERs, taking into consideration primary and tertiary mitigation measures, which are a vital component of the Scheme and secondary additional mitigation, which would be incorporated into the Scheme during construction and/or operation.

16.13.3 The mitigation includes standard pollution and noise and vibration control measures during construction, as well as sensitive lighting, to be implemented through an outline CEMP. Conditions of the Draft Order and/or licences and consents will ensure the mitigation measures are implemented on site by the Contractor (see Residual Effects Assessment and Classification (REAC) table in Appendix 18.B.).

16.13.4 The outline CEMP would identify those responsible for implementing the various management plans and mitigation measures. These management plans are live documents and will require regular updates and revisions. The outline CEMP has been prepared and are provided as an appendix to the ES (Appendix 18.A.).

16.13.5 An Environmental Coordinator would be responsible for the interface between the environmental specialists and engineers. The Ecological Clerk of Works (ECoW) would support the Environmental Coordinator during construction and post-monitoring.

16.13.6 This assessment has identified that the construction, operation and maintenance of the Scheme would result in a ***minor adverse residual effect on certain aspects of the marine environment***. This results from a small loss of subtidal mud and intertidal saltmarsh habitats, and potential effects on migratory fish species.

16.13.7 The loss of saltmarsh habitat will be mitigated by enhancing the currently shaded area of the existing A494 Bridge, as well as the Greenfield Marsh site, downstream from the Scheme, which will also require post-construction monitoring for five years post-construction, documented in an EMMP (completed at pre-construction stage by the appointed contractor). With regards to the migratory fish species during construction, this will be mitigated and is

detailed in the outline CEMP (Appendix 18.A) and detailed in a full CEMP at pre-construction stage by the appointed contractor.

16.13.8 Tables 16-11 to 16-13 provide a summary of the VERs identified through desk study and site visits and surveys, their assigned value, and justification for inclusion for land take, construction and operational effects.

Table 16-11 Summary of land take effects on Valuable Ecological Receptors (VERs) in the marine environment

VER	Value	Description of effect	Effect without mitigation	Mitigation	Significance of residual effect
Dee Estuary Ramsar/SPA/SAC/ SSSI	**International**	No significant land take effects. The boundary of these sites is located 1 km downstream from the scheme footprint; therefore, no intertidal or subtidal habitats of these sites will be directly affected by land take.	Negligible	N/A	Not Significant
River Dee and Bala Lake SAC	**International**	Small loss of intertidal and subtidal (in-river) habitat which are features of interest.	Moderate adverse effect	The potential for enhancing approximately 4 Ha of intertidal habitat at the downstream Greenfield site, to mitigate for the loss of a much smaller area of intertidal habitat at the location of the proposed works. Furthermore, removal of existing bridge will allow saltmarsh species to colonise and establish. Loss of 42.4m^2 of subtidal mud habitat (footprint of the piles)[72] is considered extremely small compared to the SAC designation. This habitat type is extensive throughout the subtidal zones of the River Dee and Dee Estuary and not the Annex I habitat/primary reason for the SAC designation; therefore the removal of this habitat will not cause the extent of the habitat to significantly change, as the proposed area of removal of this habitat represents 0.006% of the total area of the River Dee and Bala Lakes SAC intertidal and subtidal habitat area.	Not significant
The River Dee SSSI	**National**	Loss of intertidal habitat which are features of interest.	Moderate adverse effect	The potential for enhancing approximately 4 Ha of intertidal habitat at the downstream Greenfield Marsh site, to mitigate for the loss of a much smaller area of intertidal habitat at the location of the proposed works. Furthermore, removal of existing bridge will allow saltmarsh species to colonise and establish.	Not significant
Migratory fish	**International**	Loss of subtidal and intertidal habitat which may cause reduction in benthic invertebrates,	Minor adverse effect	Due to the adverse effect of removing the existing bridge piers, which would cause sediment disturbance and additional underwater noise and vibration, the piers are remaining in	Not Significant

[72] Two piers (12 No. piles per pier) at 1.5m diameter. Total area per pile is 1.77m^2 with a total area of 42.4m^2.

VER	Value	Description of effect	Effect without mitigation	Mitigation	Significance of residual effect
		which is a key food source to fish species in the river.		place; however, this means there is a relatively small subtidal mud habitat deficit of 42.4m^2 of the total subtidal area, resulting in a 0.006% loss of the total subtidal area of River Dee and Bala Lakes SAC. This will be covered in the HRA Statement to inform Appropriate Assessment.	
Marine benthic Invertebrates	**Local**	Loss of and disturbance to benthic habitat and sediment.	Minor adverse effect	The potential for enhancing approximately 4Ha of intertidal habitat at the downstream Greenfield site, to mitigate for the loss of a much smaller area of intertidal habitat at the location of the proposed works. Due to the adverse effect of removing the existing bridge piers, which would cause sediment disturbance and additional underwater noise and vibration, they will remain in place, however this means there is a small subtidal habitat deficit and will likely require habitat compensation or enhancement elsewhere.	Not significant
Breeding waterbirds and waders	**International**	Loss of and/or disturbance to nesting and/or foraging habitat	Slight adverse effect	Works will be timed to avoid removal of vegetation within the nesting bird season or checks by a competent ecologist will be made prior to clearance. The Scheme will incorporate landscaping which will provide new suitable habitat for nesting. Furthermore, removal of existing bridge will allow saltmarsh species to colonise and establish to create suitable foraging and nesting habitat.	Not significant
Wintering waterbirds and waders	**International**	Loss of and/or disturbance to small areas of land used for foraging	Minor adverse effect	Habitat would be reinstated, and large expanses of intertidal habitats left untouched. The Scheme will incorporate landscaping which will provide new suitable habitat for foraging. Furthermore, removal of existing bridge will allow saltmarsh species to colonise and establish to create suitable foraging habitat.	Not significant

Table 16-12 Summary of construction effects on Valuable Ecological Receptors (VERs) in the marine environment

VER	Value	Description of Effect	Effect without mitigation	Mitigation	Significance of residual effect
Dee Estuary Ramsar/SPA /SAC/SSSI	**International**	Indirect pollution incidents leading to changes in water quality and increased siltation. Loss of, and disturbance to habitats which are a feature of the designated sites. Increased noise and vibration. Temporary lighting.	Moderate adverse effect	Tertiary mitigation measures such as pollution, silt mobilisation and noise control which are integral to the Scheme as described in the outline CEMP. Construction and demolition (bridge removal) methods including soft-start piling methods to reduce the disturbance of silt and noise for in-river works and associated habitats. Pollution, silt mobilisation and noise control measures which are integral to the Scheme, as described in the outline CEMP. Construction works are restricted to daytime working only, however, sensitive lighting will be used, if still required.	Not Significant
River Dee and Bala Lake SAC	**International**	Indirect pollution incidents leading to changes in water quality and increased siltation. Loss of, and disturbance to intertidal and subtidal habitats which are a feature of the SAC. Increased noise and vibration. Temporary lighting.	Moderate adverse effect	Tertiary mitigation measures such as pollution, silt mobilisation and noise control which are integral to the Scheme as described in the outline CEMP. Construction and demolition (bridge removal) methods including soft-start piling methods to reduce the disturbance of silt and noise for in-river works and associated habitats. Pollution, silt mobilisation and noise control measures which are integral to the Scheme, as described in the outline CEMP. Construction works are restricted to daytime working only, however, sensitive lighting will be used, if still required.	Not Significant
The River Dee SSSI	**National**	Indirect pollution incidents leading to changes in water quality and increased siltation. Loss of, and disturbance to habitats which are a feature of the SSSI. Increased noise and vibration. Temporary lighting.	Moderate adverse effect	Tertiary mitigation measures such as pollution, silt mobilisation and noise control which are integral to the Scheme as described in the outline CEMP. Construction and demolition (bridge removal) methods including soft-start piling methods to reduce the disturbance of silt and noise for in-river works and associated habitats. Pollution, silt mobilisation and noise control measures which are integral to the Scheme, as described in the outline CEMP. Construction works are restricted to daytime working only, however, sensitive lighting will be used, if still required.	Not Significant

VER	Value	Description of Effect	Effect without mitigation	Mitigation	Significance of residual effect
Fish	**National**	Accidental chemical spillages from construction machinery (e.g. fuel, lubricants and coolants) entering the water. Increased sediment mobilisation and excessive fine sediment. Increased noise and vibration during in-channel works conducted in the migration season. Temporary lighting.	Moderate adverse effect	Tertiary mitigation measures such as pollution, silt mobilisation and noise control which are integral to the Scheme as described in the outline CEMP. Construction and demolition (bridge removal) methods including piling methods to reduce the disturbance of silt and noise for in-river works and associated habitats. When the tubes reach the required depth, bored piles will be constructed by positioning an auger inside the steel tube. This way the disturbance of the silt and vibration at the riverbed will be kept to a minimum and restricted only to the steel tube-driving operations thus reducing the quantity of suspended particulates and noise within the water course which may indirectly affect fish. This construction method would be classified as an embedded mitigation measure and a mandatory requirement. Construction works will be restricted to daytime working only; however, if lighting is required, sensitive lighting will be used. In-river piling activity working hours would be limited to between 08:00 to 17:00, and no piling work to take place in the 3 hours leading up to high tide at Chester weir.	Not Significant
Marine benthic Invertebrates	**Local**	Increased sediment mobilisation and excessive fine sediment. Accidental chemical spillages from construction machinery (e.g. fuel, lubricants and coolants) entering the water and sediment.	Minor adverse effect	Tertiary mitigation measures such as pollution, silt mobilisation and noise control which are integral to the Scheme as described in the outline CEMP. Construction and demolition methods including piling methods to reduce the disturbance of silt and noise for in-river works and associated habitats. When the tubes reach the required depth, bored piles will be constructed by positioning an auger inside the steel tube. This way the disturbance of the silt and vibration at the riverbed will be kept to a minimum and restricted only to the steel tube-driving operations thus reducing the quantity of suspended particulates and noise within the water course which may indirectly affect fish. This construction method would be classified as an embedded mitigation measure and a mandatory requirement.	Not Significant
Breeding waterbirds and waders	**International**	Displacement and disturbance from vibration, noise, increased lighting and an increase in human activity. Increased sediment and dust indirectly impacting foraging habitat.	Minor adverse effect	Construction and demolition (bridge removal) methods including piling methods to reduce the disturbance of silt and noise for in-river works and intertidal areas. Pollution and noise control measures which are integral to the Scheme as described in the outline CEMP.	Not Significant

VER	Value	Description of Effect	Effect without mitigation	Mitigation	Significance of residual effect
		Abandonment of nests. Damage and/or destroy active nests. Important to note that Low numbers of breeding waterbirds and waders within scheme area.		Construction works will be restricted to daytime working only; however, if lighting is required, sensitive lighting will be used. Temporary screening if required, provided around the immediate Scheme footprint to lessen visual impacts and dampen acoustic disturbance during the breeding season (March to September). Preconstruction nesting bird checks will be completed by a suitably experienced ornithologist prior to the works taking place.	
Wintering waterbirds and waders	**International**	Displacement from noise, increased sediment impacting foraging habitat. Visual intrusion.	Minor adverse effect	Construction and demolition methods including piling methods to reduce the disturbance of silt and noise for in-river works and intertidal areas. Pollution and noise control measures which are integral to the Scheme as described in the outline CEMP. Where unavoidable, anticipated nosier construction activities should be completed for three hours either side of high tide in order for species to utilise the banks during low tide in order to both commute and/or forage. Construction works will be restricted to daytime working only; however, if lighting is required, sensitive lighting will be used.	Not Significant

Table 16-13 Summary of operational effects on Valuable Ecological Receptors (VERs) in the marine environment

VER	Value	Description of Effect	Effect without mitigation	Mitigation	Significance of Residual Effect
Dee Estuary Ramsar/SPA/SAC/SSSI	**International**	Indirect effects from increased toxicity levels from road runoff.	Moderate adverse effect	Increased road runoff not anticipated as number of lanes on the new bridge will remain the same as the existing bridge. Highway drainage and run off from adjacent land would be collected by piped highway drainage systems. These would continue to discharge into the Queensferry Drain at locations near the railway and outfall into the River Dee. Protection from accidental spillages would be provided by isolation systems allowing pollutants to be contained for safe disposal.	Not significant
River Dee and Bala Lake SAC	**International**	Indirect effects from increased toxicity levels from road run-off	Moderate adverse effect	As above.	Not significant
The River Dee SSSI	**National**	Indirect effects from increased toxicity levels from road run-off. Air pollution. Loss of habitat from shading effects.	Moderate adverse effect	Increased road runoff not anticipated as number of lanes on the new bridge will remain the same as the existing bridge. Highway drainage and run off from adjacent land would be collected by piped highway drainage systems. These would continue to discharge into the Queensferry Drain at locations near the railway and outfall into the River Dee. Protection from accidental spillages would be provided by isolation systems allowing pollutants to be contained for safe disposal. The mitigation included in the Scheme for the loss of saltmarsh and intertidal habitats arising from land take and from operational shading is in discussion with NRW. This includes the potential for the creation and/or enhancement of habitats in order to compensate for the loss of a small area of saltmarsh. The shading effects of the new replacement bridge will be mitigated for in the long-term by the removal of the existing bridge.	Not significant
Benthic marine Invertebrates	**Local**	Increased toxicity levels from road run-off entering drains.	Minor adverse effect	Highway drainage and run off from adjacent land would be collected by piped highway drainage systems. These would continue to discharge into the Queensferry Drain at locations near the railway and outfall into the River Dee. Protection from accidental spillages would be provided by isolation systems allowing pollutants to be contained for safe disposal.	Not significant
Fish	**International**	Increased toxicity levels from road run-off entering drains. Increased lighting.	Minor adverse effect	Highway drainage and run off from adjacent land would be collected by piped highway drainage systems. These would continue to discharge into the Queensferry Drain at locations near the railway and outfall into the River Dee. Protection from accidental spillages would be provided by isolation systems allowing pollutants to be contained for safe disposal. Sensitive lighting designs to keep light spillage onto the river to a minimum.	Not significant

VER	Value	Description of Effect	Effect without mitigation	Mitigation	Significance of Residual Effect
Breeding waterbirds and waders	**International**	Disturbance and displacement from increased lighting.	Minor adverse effect	Sensitive lighting designs to keep light spillage onto the river to a minimum.	Not significant
Wintering waterbirds and waders	**International**	Disturbance and displacement from increased lighting.	Moderate adverse effect	Instigation of sensitive, reduced or an avoidance of additional lighting, in particular where this affects watercourse and associated banks, to keep light spillage onto the river to a minimum.	Not significant

16.14 Summary of Residual Effects

16.14.1 The Scheme was assessed with respect to impacts on VERs for the marine environment. Potential impacts associated with land take is loss of subtidal and intertidal habitats for marine species. During construction, potential impacts were identified from increases in suspended sediments, contaminant release, underwater noise emissions and temporary lighting. During operation the presence of proposed infrastructure, accidental spill events and proposed permanent lighting on the highway and cycleways were identified as key potential impacts.

16.14.2 The construction activities within the River Dee, including the SAC/SSSI sites, are expected to cause moderate adverse effects due to indirect pollution, changes in water quality, sediment disturbance, noise and habitat disturbance. However, mitigation measures such as specific construction methods, pollution control, and noise reduction would mitigate these impacts.

16.14.3 The residual operational effects on the River Dee, and associated habitats due to potential increased pollution levels from road run-off are expected to be moderate adverse; however, mitigation measures, including improved highway drainage systems and isolation systems for accidental spillages, aim to neutralise and improve these residual effects during the operation of the road to beneficial (for further information, refer to Chapter 7: Drainage and Water Environment). In addition to this, the removal of the existing bridge means that higher pollution levels than what is already present are not anticipated.

16.14.4 The residual effects of land take on the sensitive receptors with mitigation in place are assessed as being either **neutral** or **beneficial**. There would be habitat loss within the intertidal mud, sand, and saltmarsh habitats, which are features of the River Dee SSSI, which is crossed by the Scheme, mitigated by habitat creation, which may in time lead to a **large beneficial effect**.

16.14.5 Following assessment of the sensitivities on a range of receptors including benthic habitats, fish, marine benthic invertebrates and waterbirds on each

identified impact the assessment found that all impacts were of either negligible or minor significance.

Llywodraeth Cymru / Welsh Government

A494 RIVER DEE BRIDGE REPLACEMENT SCHEME

Environmental Statement

Volume 1: Technical Assessment Report

Chapter 17 Cumulative Effects

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17. Cumulative Effects Assessment and Interrelationships

17.1 Introduction

17.1.1 This chapter reports on the assessment of cumulative effects. These are changes to the environment arising from multiple activities affecting environmental receptors or resources, occurring in combination over a period. These individual activities might not be significant taken in isolation. This chapter examines the potential for cumulative effects to occur.

17.1.2 Chapter 4, Sections 4.11 and 4.12, explained the need for cumulative effects assessment (CEA) covering the addition or interaction of effects from several sources applying to the same receptor.

17.1.3 There are two principal types of cumulative effects to be considered in this chapter:

The interaction between effects generated by the Scheme alone.

17.1.4 An example of an interrelationship effect is the loss of a small proportion of a habitat, coupled with increased noise disturbance in the remaining habitat. Together these could reduce the foraging available to a species sufficiently to reduce the local population.

The addition or interaction of effects generated by one or more other projects in combination with those of the Scheme.

17.1.5 An example of a cumulative effect is the short period of construction noise added to periods of construction noise from a series of other projects which could combine to produce a significant impact on one group of residents. Another example would be the diversion of underground and overhead services by others, that are required to build the Scheme.

17.2 Legislation and policy context

The EIA Regulations

17.2.1 The EIA Regulations, require the consideration of interrelationships and cumulative effects. The information required includes the assessment of '*the direct effects and any indirect, secondary, cumulative, short, medium and long term permanent or temporary, positive and negative effects of the project*'.

17.3 Relevant Guidance

17.3.1 The CEA was undertaken in accordance with guidance set out in Design Manual for Roads and Bridges (DMRB) LA104 Rev 1. This short set of notes advises that the scope of the assessment of cumulative effects should report on roads projects which have been confirmed for delivery over a similar timeframe, and:

a. other development projects with valid planning permissions or consent orders, and for which EIA is a requirement; and
b. proposals in adopted development plans with a clear identified programme for delivery.

17.3.2 The assessment needs to include a desk study and mapping exercise, together with a review of planning/development applications and development plans to:

a. establish the zone of influence for the project together with other projects;
b. identify a list of projects which have the potential to result in cumulative impacts;
c. obtain further information and detail on the list of identified projects to support further assessment.

17.3.3 LA104 gives no defined limits or criteria for selecting the list of projects for cumulative assessment, although it first indicates, that projects selected should be those subject to EIA, and later indicates that professional judgement '*using Annex III of the EIA Directive 2014/52/EU [Ref 1.N] can be applied and justification provided for developments selected (and excluded)*'. *The temporal*

and spatial scope, together with characteristics of the identified projects, are key considerations in identifying projects that require further assessment.

Advice Note 9

17.3.4 Advice Note 9 version 3: Using the Rochdale Envelope (Planning Inspectorate, 2018). Although not specifically designed for highway schemes, the Planning Inspectorate guidance note provides more recent guidance on good practice for the assessment of cumulative effects for major infrastructure schemes, particularly where there is uncertainty or a need for flexibility within the proposal.

17.3.5 The Planning Inspectorate Advice Note 9 Version 3 (2018) states that 'The potential cumulative impacts with other developments will also need to be carefully identified such that the likely significant effects can be shown to have been identified and assessed against the baseline position (which would include built and operational development). In assessing cumulative impacts, other development should be identified through consultation with the local planning authorities and other relevant authorities. Applicants should have regard to the staged approach to cumulative effects assessment set out in Planning Inspectorate's Advice Note Seventeen: Cumulative Effects Assessment'.

Advice Note 17

17.3.6 Advice Note 17: Cumulative effects assessment relevant to nationally significant infrastructure projects (Planning Inspectorate, 2015) which gives a systematic approach to 'other development' assessments for cumulative impacts, identifying tasks and suggesting templates.

17.3.7 The Planning Inspectorate Advice Note 17 identifies a wider range of proposed developments to be considered, noting that the certainty of implementation and the level of information available is likely to decrease from a) to g):

a. Developments under construction.

b. Permitted applications not yet implemented.

c. Submitted applications not yet determined.

d. Planning applications where a scoping report was submitted.

e. Projects on the planning register where a scoping report was submitted.

f. Sites identified in the relevant LDPs (and emerging LDPs – with appropriate weight being given as they move closer to adoption).

g. Other plans and programmes (as appropriate) which set the framework for future development consent / approval, where such development is reasonably likely to come forward.

17.4 Consultations

17.4.1 The Environmental Liaison Group meetings have been held throughout the development of the Scheme and previous proposals for the replacement of the Dee Bridge. All the statutory environmental consultees, as well as NMWTRA and Flintshire County Council were invited to attend.

17.4.2 In response to the submitted EIA Scoping Report, Natural Resources Wales (NRW) provided a scoping opinion and made comments regarding the assessment of cumulative effects. They asked that the cumulative assessment should take into consideration any effects of greater than of negligible significance. The stated reason for this was that as the overall effect of many minor impacts over several projects may add up to a significant cumulative effect overall. 'Significant' in EIA terms, refers to the subjective importance or weight that should be placed on an impact during the decision-making process, meaning it is 'material' to the planning decision. In this context, it is understood that the 'several projects' referred to are those that would affect the Dee estuary and the sediment and marine wildlife it supports. These include works in and around Mostyn Dock and Point of Ayr.

17.4.3 The assessment methodology is based on the Scheme's Zones of Influence (ZoI) and in this case the sites mentioned above are within the 30km radius of the biodiversity assessment. These projects have therefore been considered in this cumulative assessment.

17.5 Assessment Methodology

17.5.1 This CEA is intended to be a "proportionate and pragmatic process" as stated in Planning Inspectorate Advice Note 17 (sections 3.4.5 and 3.4.6). The CEA should 'not be any longer than is necessary to identify and assess any likely significant cumulative effects that are material to the decision-making process, rather than cataloguing every conceivable effect that might occur.' Professional judgement has been used to narrow the area and scope of the assessment to potentially significant effects and interactions, as described in Section 17.3.

Interrelationships

17.5.2 Each of the EIA aspect chapters includes a section that considers:

a. the interrelationship between impacts on receptors or receptor groups[1].
b. relevant interrelationships that are 'scoped-in' for the Scheme,
c. potential effects, mitigation and monitoring measures.

17.5.3 The interrelationships assessed within each aspect chapter are collated and reviewed against the Scheme to ensure a consistency of assessment. This four-stage process for assessing interrelationships is summarised in Table 17.1.

Table 17.1: Method of Assessment for interrelationships in CEA

Stage		Description
1	Identify receptors / resources affected	Scope-out receptor / resources not affected by in-combination effects or assessed to be only affected by a single EIA aspect.
2	Identify impacts on receptor / resource	Review of likely receptor(s) / resource affected by more than one impact through analysis of the assessment of effects sections undertaken for individual EIA aspect.
3	Identify In-combination effects	Identify potential in-combination effects on likely receptors through review of the assessments in the EIA aspect chapters.

[1] For instance, effects on ecological receptors arising from any combination of land take, noise / visual disturbance, air quality impacts, water quality impacts and potential traffic collision are considered within the biodiversity chapter.

Stage		Description
4	Evaluate the ability of receptor/resource to absorb further effects before changes become irreversible?	Assess how individual impacts may combine as interrelated effects on a receptor for: '**Project lifetime effects'**: construction, operational and decommissioning). '**Receptor-led effects'**: multiple simultaneous effects on a single receptor.

Source: DMRB Volume II Section 2 Part 5 HA 205/08 Part IV paragraph 2.14

17.5.4 Chapter 6 to 17 of this environmental assessment set out the relevant criteria used to determine the significance of an effect. Criteria set out in Table 17.4 were applied to interrelationships assessed for this CEA (Stage 4 in Table 17.1).

Scoping of cumulative 'interrelationship' effects

17.5.5 Many of the specialist topic chapters of this ES consider the full range of potential effects of the Scheme on a single receptor or group of receptors. Their conclusions therefore include consideration of possible interrelationship effects and relevant mitigation measures. These ES topics are listed in Table 17.2.

17.5.6 Table 17.2 identifies several receptor 'inter-relationships' for the Scheme. terrestrial or marine biodiversity is reflected in several of the specialists' assessments as the most likely for potential cumulative interrelationship effects. ES specialists, for Road Drainage and Water Environment, Noise and Vibration, Materials and waste, identify the potential for effects on receptors. The specialists assessing Landscape and Visual effects, Air Quality, Population and Human Health, have less potential to cause cumulative interrelationships effects. Noise and Vibration is highlighted with a potential to represent a significant inter-relationship effect with those of Biodiversity, Landscape and Visual Impact Assessment, Air Quality and Climate Change receptors.

Table 17.2: ES topics which include inter-relationship effects

Topic receptor / resource	Significant effect?	Notes
Chapter 6 Geology and soils	No	No inter-relationship impacts: between the geology and soils receptors identified for the Scheme.

Topic receptor / resource	Significant effect?	Notes
Chapter 7 Water environment	No	Inter-relationship impacts: Chapter 6: Geology and Soils, Chapter 8: Biodiversity, Chapter 13 Materials and waste, Chapter 14 Population and human health Chapter 16: Marine Environment No significant effects are identified.
Chapter 8 Biodiversity	No	Inter-relationship impacts: Chapter 6: Geology and soils; Chapter 7: Water environment; Chapter 9: Landscape and visual; Chapter 11: Air quality; Chapter 12: Noise and vibration; Chapter 13: Materials and waste; Chapter 15: Climate Chapter 16: Marine Environment No significant effects are identified.
Chapter 9 Landscape and visual	No	Inter-relationship impacts: Chapter 8: Biodiversity Chapter 10: Cultural heritage; Chapter 14: Population and human health. No significant effects are identified.
Chapter 10 Cultural heritage	No	Inter-relationship impacts: Notes main potential source for interaction is the industrial period associated with the marine trade and the River Dee and the associated development of Queensferry. No significant effects are noted.
Chapter 11 Air quality	No	Inter-relationship impacts: Chapter 8: Biodiversity; Chapter 13: Noise and vibration; Chapter 14: Population and human health; Chapter 15: Climate. Chapter 16: Marine Environment; Concludes that on the basis of the CEMP measures no significant effects.
Chapter 12 Noise and vibration	No	Inter-relationship impacts: Chapter 8: Biodiversity; Chapter 9: Landscape & visual; Chapter 12: Air quality; Chapter 17: Climate No significant effects are predicted.

Topic receptor / resource	Significant effect?	Notes
Chapter 13 Materials and waste	Yes	Inter-relationship impacts: Chapter 6: Geology and soils; Chapter 7: Water environment; Chapter 8: Biodiversity; Chapter 17: Climate. Notes the need to consider material resources and waste minimisation.
Chapter 14 Population and human health	Yes	Inter-relationship impacts: Chapter 12: Air quality; Chapter 13 Noise and vibration; Effects noted during construction: Chapter 12: Air quality; Chapter 13: Noise and vibration. Effects with Noise and vibration noted as representing a significant beneficial impact with private assets.
Chapter 15 Climate	Yes	Inter-relationship impacts: This is assessed at a national cumulative level and includes the sum of carbon emissions for a range of sectors i.e., not limited to highway infrastructure Schemes. In regard to the Scheme there are potential effects to climate resilience and a positive effect with increased transport network resilience to flooding.
Chapter 16 Marine Environment	No	Inter-relationship impacts: Chapter 6: Geology & Soils Chapter 7: Road drainage & water environment Chapter 8: Biodiversity Chapter 9: Landscape & Visual Chapter 12: Noise & Vibration Chapter 13: Materials & Waste Chapter 15: Climate Concludes that primary, secondary and tertiary mitigation measures and implementation of the CEMP, would result in no significant cumulative effects.

17.5.7 The key environmental receptors to this Scheme emerge from the assessments as biodiversity and the marine environment because of the sensitivity of the resource provided by the River Dee SAC and SSSI, as well as the Dee Estuary SAC, SPA and Ramsar designations. Any unplanned changes to the Scheme could give rise to additional CEA effects. Biodiversity and the marine environment are also assessed as part of the accompanying Habitat Regulations

Assessment (HRA), and this is reported in a 'Statement to Inform an Appropriate Assessment'.

17.5.8 A Register of Environmental Actions and Commitments (REAC) and a Construction Environmental Management Plan (CEMP), which are appended to this ES, set out commitments and measures required to avoid, minimise or mitigate adverse effects on a range of biodiversity and marine environment features. The effects include those that might arise during construction and the inter-relationship effects with population and human health, and noise and vibration[2].

17.5.9 The Study Area is normally defined in such a way that all significant effects can be contained within it. Available guidance does not define a specific 'study area' for a CEA but instead recommends a proportionate and systematic process. The starting point is therefore based on the individual study areas for each of the ES aspect chapters 6 to 16. These have been used to consider interrelationships in this assessment. Contained within the study area there is normally a Zone of Influence (ZoI) where actual effects are likely to occur.

17.5.10 An example demonstrating the difference:

Study Area: Assessment of the Scheme on views from properties would be establishing a maximum extent to which views might be expected to occur (the worst case).

Zone of Influence: Identified by the actual extent of views which could be curtailed by landform or large buildings.

17.5.11 For the in-combination assessment a four-stage approach identifies 'other developments' within the ZoI of the Scheme. In accordance with Planning Inspectorate guidance reasonably foreseeable developments are identified through a systematic search and then screened to select those which could have 'in-combination' effects.

[2] The HRA separately assessed the potential impacts of '*other developments*.'

17.5.12 Matrices present the process and findings. Briefly, the activities within each of Stages 1 to 4.

Stage 1: Establish ZOI and identify a long list of 'Other Developments'

17.5.13 Proposed developments, including transport or minerals-related developments, and land use allocations in the adopted LDP, in closest proximity to the site and to the outer limit of the study area included within Flintshire County Council and Cheshire West and Chester Council planning authority areas. A search of the Planning Inspectorate website has also been undertaken, to identify any Nationally Significant Infrastructure Projects, planning appeals or 'call in' proposals in the vicinity of the Scheme, together with the Marine Planning Portal Wales details. The last search for projects were completed in April 2025, at the time of writing this chapter and therefore it is recognised that new projects that emerge after that date may not be included in the list.

17.5.14 The CEA boundary, shown in Figure 17.2, was identified and confirmed through consultation with Planning Services at Flintshire County Council (FCC)[i]. The list included a total of twenty-six separate 'Other Developments'. Several of these development sites were positioned near the periphery of the Scheme CEA boundary where interaction could be restricted to theoretical views of the Scheme and ecological receptors which lie within a 5km to 30km ZoI.

Table 17.3: ZoIs applied to the cumulative assessment

Environmental Specialism	Zone of Influence (ZoI)
6. Geology and soils	500 m
7. Drainage and the Water environment	500 m
8. Biodiversity	30 km
9. Landscape and visual effects	2 km and within ZTV
10. Archaeology and cultural heritage	500 m

Environmental Specialism	Zone of Influence (ZoI)
11. Air quality	500 m
12. Noise and vibration	1 km
13. Materials and waste	Scheme footprint
14. Population and human health	scoped out of cumulative chapter
15. Climate	Scheme footprint: land take and the extent of delivery routes to and from site.
16. Marine environment	12 km to cover hydrologically connected statutory designated sites.

Stage 2: Identify a shortlist of 'Other Development'

17.5.15 These are identified by applying inclusion / exclusion criteria to the Long List of 'Other Development' for cumulative effects.

Stage 3: Gathering information on projects listed in Stage 2.

17.5.16 To allow developments to be categories as:

a) Development under construction.

b) Application permitted but which are not yet implemented.

c) Submitted applications not yet determined and which, if permitted, would affect the proposed development in the scoping request.

d) Development identified in the adopted and emerging development plan (with appropriate weight being given as they move closer to adoption), recognising that information on any relevant proposals will be limited.

17.5.17 Projects were further categorised as either 'major' developments; EIA developments and/or developments with sensitive receptors or unique matters

relevant to the Scheme. Information and development descriptions were taken from planning application documents where available and from developer websites or similar sources for projects not yet at formal planning application stage.

Stage 4: Detailed assessment of each 'Other Development'

17.5.18 This stage required an assessment of overlap in effects between the Scheme and other developments.

17.6 Assessing significance

17.6.1 DMRB[3] highlights that 'The focus in assigning significance to cumulative effects should be determined by the extent to which the impacts can be accommodated by the receptor / resources. Thresholds (limits beyond which cumulative change becomes a concern) and indicative levels of acceptable performance of a receptor / resource may also aid the assessment process'.

17.6.2 DMRB also suggests that 'it is useful to standardise significance criteria for cumulative effects' using the framework in Table 17.4.

Table 17.4: Assigning significance to cumulative effects

Significance	Effect
Severe	Effects that the decision-maker must consider as the receptor / resource is irretrievably compromised
Major	Effects that may become key decision-making issue
Moderate	Effects that are unlikely to become issues on whether the project design should be selected but where the future work may be needed to improve current performance
Minor	Effects that are locally significant
Not significant	Effects that are beyond the current forecasting ability or are within the ability of the resources to absorb such change.

Source: DMRB Volume II Section 2 Part 5 HA 205/08 Part IV paragraph 2.14

3 DMRB Volume II Section 2 Part 5 HA 205/08 Part IV paragraph 2.14

Limitations of the Assessment

17.6.3 This ES chapter uses the approach set out in DMRB and other relevant guidance for assigning 'significance', as set out in Table 17.4. This is different to the main ES topic assessments and is focused on inter-relationships which are 'moderate' or greater. This means that, for the assessment of 'significant effect' for CEA, this relies on the ES topic specialists' experience of the assessment requirements for cumulative effects.

17.6.4 The characterisation of 'other developments' is dependent on the thoroughness of information from several sources, and this includes information from the Local Planning Authority databases and in published documents. For developments at earlier stages, particularly Local Development Plan allocations, and for applications for which EIA has not been undertaken, professional judgement and knowledge of the wider study area were employed to consider the receptors or resources that may be affected by the Scheme and the 'other development' in question. Although the proposed timescale for the construction of the Scheme is known, the timescale over which the potential impacts from 'Other Developments' may arise cannot be determined with certainty. The information given in Matrix 1 and Matrix 2 (Appendices 17.A and 17.B) sets out indicative timescales derived in consultation with the LPA and other sources, but the potential for overlapping of effects, particularly those arising from construction activity, is therefore unpredictable.

17.6.5 The Planning and Environment Decisions Wales (PEDW) service has indicated that pre-application views provided in response to a potential new development should also be considered as part of a CEA approach. Consultation with the LPA concludes that, alongside matters of commercial confidentiality, that this would be difficult to achieve generally.

Additional elements of the scheme

17.6.6 The description of 'Other Developments' used in CEA does not include development works which could be completed as 'permitted development rights',

for example, by the statutory role of Highway Authorities[4]. The following paragraphs describe additional elements of the Scheme which would be carried out in advance of the bridge construction, or during construction, which might be considered to have potential to cause cumulative effect on the environment. The Dee Bridge Scheme is described in Chapter 2, section 3 (2.3).

Service diversions

17.6.7 A consequence of implementing the Dee Bridge Scheme would be the requirement to divert underground and overhead services in advance of construction in the immediate area. The main utility companies with assets in the area are Dŵr Cymru Welsh Water, Wales and West Utilities, Scottish Power Energy Networks and BT Openreach Service. Diversion works, which could cause adverse environmental effects, would include:

a. Dŵr Cymru Welsh Water rising mains diversion to include thrust boring of 4 new pipelines under the River Dee to the southeast of the bridge, and across adjacent land to the north and south of the river. The construction programme allows some flexibility, but the new diverted pipeline would be completed and in service before the old pipeline, which is fixed to the existing A494 Dee Bridge, can be disconnected and dismantled.

b. Scottish Power Energy Networks diversion of 33kV cables and 11kV low voltage cables underground across the A494 and thrust bored underground to cross the River Dee to the northwest of the existing bridge.

c. Wales and West Utilities diversion of a medium pressure gas main to the south of the Dee bridge, across the A494.

d. General BT diversions across the scheme. (BT Openreach).

17.6.8 The utility companies develop and undertake diversions as separate projects to the main Scheme and use their own statutory powers to put in place any necessary permits. The diversion works need to be completed in such a way

4 Part 13 of the 1995 General Permitted Development Order (as amended) sets out the relevant 'permitted development rights' (PDR's) for development by Highway Authorities

that they do not delay the completion of the much larger Scheme or result in disruption of services.

17.6.9 Conventionally the diversion of services would be completed in advance of the Scheme but where circumstances allow some diversions could be concurrent with the Scheme and so there is potential for some temporary permanent cumulative impacts. In some circumstances the scale and complexity of the diversion, or the duration of the works mean that there is an overlap of construction activities resulting in concurrent temporary or permanent cumulative impacts. The contractor for the Scheme and the utility company liaise to plan and programme their respective works to minimise disruption to services and to avoid abortive costs.

Jack-up barge for piling

17.6.10 The construction of the two bridge piers in the River Dee would each require twelve foundation piles, leading to a total of twenty-four 1.5m diameter piles for the new bridge. The piling work is considered likely to require in river working using a ‘jack up’ barge. It is anticipated that the in-river piling works could take 4 to 12 months, depending on the Contractors detailed construction methodology, sequencing and programme.

17.6.11 The barge would be prepared and modified at Birkenhead Docks before being towed to the site of the A494 Dee Bridge and docked at a temporary jetty. Final preparations would be made with cranes, piling rig and other equipment installed on the barge and on shore. When ready the barge would be moved in turn to the location of the proposed piles and ‘jacked up’, to make it stable for the piling works to commence. Over a period of May to August, or slightly later, the piling works will continue. On completion of these works the barge would be unloaded and towed to Birkenhead. The trip would require two crossings of Liverpool Bay.

17.7 Assessment of Cumulative Effects from the Scheme

Summary of cumulative effects

17.7.1 The Scheme has undergone an iterative design process that has responded to the emergence of any interim findings of the environmental assessments to avoid, minimise or reduce potential environmental impacts. This has in turn has assisted in identifying and addressing potential 'inter-relationship' effects to avoid significant impacts. A significant effect is normally considered as a 'moderate' effect for the interrelationship.

Long list of sites

17.7.2 The searches identified a long list of 51 'Other Developments'[5] and these are presented in Appendix 17.A. A review of these included a systematic description of the type of development and the relationship with the Scheme. The majority of the 'other developments' descriptions include sites which are allocated within the defined Flintshire LDP and either have a planning permission or are currently awaiting a decision or are in an EIA process. The following criteria have been used to compile the initial longlist, and to screen out development of insufficient scale, or of a type that would not result in cumulative effects with the Proposed Development:

a. any planning applications older than five years at the commencement date of study;

b. construction of small-scale agricultural buildings;

c. house extensions or cosmetic changes to buildings;

d. work to trees;

e. micro-generation wind turbines;

f. roof mounted solar PV panels (or ground mounted less than 50 kW output);

5 During the review of the EIA screening and scoping opinion register, details regarding proposed acoustic barriers along the A494 in the Aston area were noted. In particular, current details (see above, footnote 6) indicates that the works at this stage of the CEA detailed review, cannot be included as part of a CEA description of 'other developments'

g. renewal of planning permission for retention of existing operational use;

h. variation to planning permissions, including reserved matters;

i. applications (where the original application would not have been considered within the assessment);

j. small-scale residential uses or changes of building use (unless it could itself result in a cumulative effect, such as a conversion of several barns into a holiday village.

17.7.3 From the long list 17 sites have been identified for the 'shortlist'. Identified sites are not all within the administrative boundaries of Flintshire County Council. The short-listed locations are shown in Figure 17.3 and are described in detail in Appendix 17.B.

Shortlisted sites

17.7.4 Nine of the shortlisted locations are within a 2 km radius of the Scheme; four are located at the northern end of the Scheme and in proximity to each other. A further three sites are located over 20km east northeast at Mostyn, in the outer estuary. These last three have been included in response to NRW comments. The CEA reference is a number used to identify a site in the appendices:

Table 17.5: Short listed sites

CEA ref.	Site name	Distance from centre or closest point
1	The Northern Gateway	2 km
2	former Corus Garden City site	1.7 km
6	Connah's Quay Low Carbon Power 2 phase project: Combined Cycle Gas Turbine (CCGT) Generating Plant fitted with Carbon Capture Plant (CCP).	4.5 km

CEA ref.	Site name	Distance from centre or closest point
7	Crump's Yard	2.9 km
8	Land to the north of Shotton Paper: piling works at the paper machine for redevelopment and expansion of existing: October 2022 planning permission for the redevelopment and expansion of former UPM Shotton Paper Mill site	3.6 km
9	Land east of Shotton Paper: waste management facility for the management of municipal, commercial and industrial waste	3.6 km
10a	Land off Ffordd Pentre, Sandycroft. Anaerobic digester waste facility.	550 m
37	Port of Mostyn Extension: construction of a new quay wall and the reclamation of approximately 4.5ha of land behind the new sea wall. Dredging works to commence shortly and be completed for operation in 2027. Required for the creation of new berths, and the deepening of existing berths and approach channel and will be required for future maintenance activities. Marine Works licence granted The Approved development is a change affecting the estuary.	21 km

CEA ref.	Site name	Distance from centre or closest point
38	Port of Mostyn maintenance dredging activity by means of cutter suction hopper dredger at Mostyn Harbour which will be pumped through a floating pipeline directly into the Mostyn Breakwater disposal site. Deepening channel by 4 metres and removing 450,000m3 annually for three years.	21 km
39	Tidal Lagoon in Dee estuary Mostyn Dock: proposals for a tidal lagoon in the outer Dee Estuary. A 6.7 km boundary wall extending from the Port of Mostyn to the Point of Ayr at the estuary mouth. Produce low-carbon electricity, create 300 jobs during construction and provide flood protection to a hinterland that includes homes and businesses as well as the A548 Coast Road and the North Wales coast railway line.	21 km
40	Shotton Paper Mill: one of the largest development sites with planning permission approved for the redevelopment of this site in October 2022 and acknowledges that routes to the site are within the vicinity of the Scheme. The approved development, together with the DNS application for the site, represents a significant scale of ‘change’ within proximity to the northerly end of the Scheme.	3 km

CEA ref.	Site name	Distance from centre or closest point
41	Hydrogen Ready Gas Plant at Deeside Power station: former building to be used as a Hydrogen-ready Gas Peaking Plant. screening opinion was no EIA required. Screening report from applicant suggests atmospheric nitrogen deposition would increase with impact on sensitive receptors.	3.5 km
44	HyNet Carbon Dioxide Pipeline: new build CO2 pipeline that will transport CO2 produced and captured by future hydrogen producing facilities and existing industrial premises in Northwest England and North Wales for offshore storage.	800 m
45	Heidelberg plant spur pipeline: 10km linear route from Padeswood to Northop Hall.	5.5 km
46	Padeswood Carbon Capture and Storage: plant to capture CO_2 from the Heidelberg Cement plant.	6.5 km
51	Sealand Manor Solar Farm covering some 90 hectares on the north bank of the Dee adjacent to the A494.	Overlapping/adjacent
A	A55/A494/A548 Flintshire Corridor infrastructure project: refer to paragraph 17.7.5.	Adjacent

17.7.5 Collectively, CEA sites identified to the northwest of the Scheme represent a potentially significant change to the existing locality. The new-build future developments will form a significant addition to the Deeside Enterprise Zone, a well-established strategic masterplan for economic enterprise in the Region.

17.7.6 The Welsh Government's proposed A55/A494/A548 Flintshire Corridor infrastructure project (linking Deeside Park Interchange to the Flintshire Bridge and Northop, west of the scheme[6]) could represent an additional, significant transport development within the same locality. This could contribute towards further changes and impacts but following the Welsh Governments publication of their investment plan, this project is unlikely to proceed in the same timescale at the Scheme.

Consideration of cumulative effects

17.7.7 Consideration of potential cumulative effects on biodiversity and on the marine environment, particularly on sites and species designated under the Habitats Regulations as SAC, SPA and Ramsar sites, forms part of the Habitats Regulations Assessment (HRA) ('Assessment of Implications for European Sites') and is reported separately in the Habitat Regulations Assessment (HRA) screening and appropriate assessment. It is also summarised in Chapters 8 Biodiversity and Chapter 16 Marine Environment.

17.7.8 Matrix 2, in Appendix 17.B, shows the consideration of cumulative effects of the 17 shortlisted projects against each ES topic considered in this ES. Within the limits of information available, each project was reviewed to assess whether likely effects would:

a. Extend to overlap with effects of the A494 Dee Bridge Improvement Scheme, affecting the same receptors.

b. Arise or apply at the same time as effects of the Scheme (temporary effects).

c. Add together to generate significant effects.

17.7.9 The following sites appear to have potential to have significant in-combination effects with the Scheme. These are shown in Table 17.6.

[6] At the time of the final preparation of this ES Chapter the route included as part of the new FCC Local Development Plan and the outcome of the WG Transport review awaited. The final review conclusions were announced on the 14 February 2023;www.gov.wales/roads-review and www.gov.wales/sites/default/files/pdf-versions/2023/2/2/1676385038/welsh-government-response-roads-review.pdf

17.7.10 In addition, the likely effects assuming that any effect greater than negligible is considered significant. Are shown in the Shortlist matrix in Appendix 17 B.

Table 17.6: Possible significant cumulative effects

Ref	Scheme	Likely Significant effects (Moderate or greater)
1	Northern Gateway	Transport and construction waste
2	Former Corus Garden City Site	Transport and construction waste
6	Connah's Quay Low Carbon Power	Biodiversity and Marine Environment
7	Crumps Yard	Construction waste
8	Land North of Shotton Paper	Construction waste
39	Tidal Lagoon in Dee Estuary Mostyn Dock Sea Power	Marine Environment, Biodiversity Effects unknown at this very early stage. The Scheme may be completed long before this project commences.
51	Sealand Manor Solar Farm	Traffic and transport, Landscape and visual

Road drainage and water environment Chapter 7

17.7.11 Cumulative effects are not anticipated where construction of 'other developments' is not concurrent with the Scheme. Where other developments are located at a distance greater than 2km from the Scheme, it is likely that appropriate mitigation and attenuation process will prevent any cumulative significant effects.

17.7.12 Construction works on the Northern Gateway residential development, which lies within 2km of the Scheme, are anticipated to be completed in 2025, therefore cumulative potential construction effects are not anticipated.

17.7.13 Sealand Manor Solar Farm is located immediately adjacent to the Scheme. The solar farm is in the early stages of planning and therefore, concurrent construction is unlikely, and thus, cumulative potential construction effects are not anticipated.

17.7.14 During operation of the Scheme, it is assumed that surface water from 'other developments' including Northern Gateway (residential development) and Sealand Manor Solar Farm will be managed under detailed surface water Drainage Strategies that encompass Sustainable Drainage Systems (SuDS) to ensure that there is no increased risk of flooding from surface water. No significant cumulative effects are therefore anticipated within the Dee catchment.

17.7.15 The Scheme was assessed to have a beneficial effect on water quality due to improved drainage treatment and therefore will not contribute to a deterioration in water quality in combination with other Schemes.

17.7.16 The A494 Dee Bridge Scheme results in highly localised changes in the River Dee. Consequently, operation of the Connah's Quay Low Carbon Power (new combined-cycle gas turbine power station) is not anticipated to have any operational cumulative effects. There is potential risk associated with removal of saltmarsh and changes to tidal flood risk which in combination with the Scheme could result in a significant effect. However, as the Connah's Quay Low Carbon Power Scheme is in the early stages of planning and there is limited detail available on the scheme design to inform a cumulative assessment at this stage.

17.7.17 The proposed Tidal Lagoon at Mostyn Dock is located 21 km downstream. The Schemes potential effects are unlikely to result in cumulative impacts on physical processes at this distance.

Biodiversity Chapter 8

17.7.18 Chapter 8 considers potential cumulative effects on terrestrial biodiversity to relate primarily to two projects: Connah's Quay Low Carbon Power and the Tidal Lagoon in Dee Estuary.

17.7.19 Based on a systematic assessment, the terrestrial biodiversity in the vicinity of the Dee Bridge replacement scheme is unlikely to be significantly impacted by the Connah's Quay Low Carbon Power project or the Tidal Lagoon in the Dee estuary. The Connah's Quay project, located 4.5 km downstream, is a redevelopment on a brownfield industrial site, meaning it does not involve new incursion into natural habitats. The significant intervening distance and the downstream location preclude any plausible impact pathways from direct habitat loss, hydrological pollution, or atmospheric deposition affecting the bridge area. While mobile species like otters and birds may range between the locations, the localised nature of the works at Connah's Quay, combined with the existing industrial baseline to which wildlife is already habituated, means no significant population-level cumulative effects are anticipated for the distinct terrestrial species at the bridge site.

17.7.20 The proposed Tidal Lagoon at Mostyn Dock is located 21 km downstream and is an entirely marine and coastal engineering project. This geographical separation and the fundamentally different nature of the project eliminate any direct impact pathways on the terrestrial habitats and species at the Dee Bridge. The project's primary effects are on marine hydrodynamics in the outer estuary, which would have an imperceptible influence on the fluvial-dominated river section 21 km upstream. The only potential, albeit weak, pathway for cumulative effects would be through highly mobile species such as otters or estuarine birds. However, the vast scale of the wider Dee Estuary provides extensive alternative habitats, and the bird species most likely to be affected by the lagoon are ecologically distinct from the terrestrial bird communities identified as important at the bridge scheme. Therefore, due to the substantial distances and the absence of any functional ecological connectivity, neither project is expected to result in significant cumulative adverse effects.

Landscape and visual Chapter 9

17.7.21 A significant cumulative impact is identified in connection with two ‘other developments’ the Northern Gateway and the RAF Sealand site. The Northern Gateway Mixed Use Development Site is a key strategic site in Flintshire, located next to Deeside Industrial Park and Garden City and alongside the B5441 Welsh

Road and the River Dee, encompassing land formerly associated with RAF Sealand and Sealand Bank Farm. This site is a designated Enterprise Zone within a sub-regional economic hub and at the entrance to Flintshire and Wales.

17.7.22 Redevelopment of the Former RAF Sealand Site to provide employment and residential areas with road infrastructure, green corridors and recreational spaces. The Environmental Statement for the Outline application for the whole development states that it sits in a low-value landscape with limited visual appeal, primarily within the context of the Deeside Industrial Park. Generally, there will be minor to negligible adverse effects on the overall landscape character during construction and after completion, users of the Millennium Greenway (NCN5) will experience significant visual impacts during construction, which will lessen to moderate once new tree planting matures. Views from Garden City and the River Dee footpath will initially face moderate to minor adverse impacts, evolving into minor adverse or beneficial impacts with mature vegetation.

17.7.23 The RAF Sealand site is divided into development plots with separate planning applications and more detailed proposals. Plots A to D in the north of the site are dedicated to large-scale employment sites. Plots 1 to 3 are dedicated as mixed-use development including retail and residential. Plots H1 to H8 are dedicated as residential areas with some small-scale industrial units. The undeveloped plots are gradually being developed. A breakdown of the development plots is provided in Table 17.7.

Table 17.7: Breakdown by development plot

Development plot	'Other Development' LVIA conclusions, if any
Plot A developed as a distribution warehouse and is operational.	No assessment provided to support the application for approval of details
Plot B under development as a distribution warehouse.	No assessment provided to support the application for approval of details

Development plot	'Other Development' LVIA conclusions, if any
Plot C is being developed into a paper processing mill.	LVIA: a change the landscape character of the site is a Minor/Moderate Adverse significance of effect. A Minor/Moderate Adverse effect is also stated for the *River Dee* character area. A significant cumulative adverse short to medium-term effect is predicted for LCA050 River Dee Canal. For the 40m high bay warehouse the LVIA states that a Moderate/High to High adverse visual impact is predicted for users of the NCN5, Chester Millennium Greenway and the River Dee eastern bank Public Footpath. No significant cumulative visual effect is predicted for the view from footpath.
Plot D is developed into storage and distribution warehouses	An LVIA was not provided to support the application for approval of reserved matters.
Plots 02, H1, H2, H3, H6, H7, H8 are substantially completed residential areas. Plot H4/H5 is used as a construction site compound. Plot 01 under planning for a retail unit	An LVIA has not yet been provided for Plot 01.

Development plot	'Other Development' LVIA conclusions, if any
Corus Garden City allocated for employment and residential use. Later application for some warehousing.	LVIA for the outline application states that there would be significant adverse landscape impact and significant adverse visual impact to residential areas of Garden City. Subsequent revised LVIA was submitted but no additional adverse landscape and visual impact identified.

17.7.24 The *Sealand Manor Solar Farm* proposal is at a consultation stage. It occupies land classified in the Local Development Plan as Green Wedge. The application would be submitted to the Welsh Government as a Development of National Significance. The LVIA indicates that the change is reversible with a potential significant adverse cumulative visual impact for some local residential properties and for users of the Wales Coast Path and public rights of way.

Air Quality Chapter 11

17.7.25 Chapter 11, notes considerations of the potential, but currently unlikely, Flintshire Corridor Route, noting that the current and future traffic data. No cumulative effects are predicted with that project. Whilst there is also potential for in-combination effects to arise with the Hydrogen-ready Gas Peaking Plant, the combined effects will be negligible.

Noise and vibration Chapter 12

17.7.26 Several projects are proposed surrounding the Scheme (Dee Bridge). The cumulative effects of projects that fall within the noise and vibration study area of 1km have been assessed. These projects are listed below:

a. Anaerobic Digester Waste Facility (land off Ffordd Pentre, Sandycroft).

b. HyNet Carbon Dioxide Pipeline.

c. Sealand Manor Solar Farm.

d. A55/Flintshire Corridor Infrastructure Project.

e. Utility Diversion Works (Rising Mains & 11kV HV Overhead Cables)

17.7.27 A planning application for the construction of an anaerobic digester waste facility, proposed to be located on the land off Ffordd Pentre, Sandycroft has been submitted. The proposed construction programme timeline is currently unknown. The site is to be located within 350m of mutual noise sensitive receptors with the Dee Bridge Scheme (represented by ST4 in Appendix 12-B of the ES). A significant cumulative effect is not anticipated, due to the Scheme's (Dee Bridge) works in proximity to the land off Ffordd Pentre being limited. In addition, there are limited noise sensitive receptors in proximity, and both a significant distance away and there is sufficient shielding from buildings between ST4 and the proposed project.

17.7.28 It is anticipated that the construction of the HyNet carbon dioxide pipeline will commence in 2026 and run concurrently with the construction of the Dee Bridge Scheme. The proposed pipeline will be located 800m at the closest point from the Scheme (Dee Bridge). Construction works for the pipeline are anticipated to be at a distance that, should there be concurrent works for the new Dee Bridge, will produce negligible and therefore not significant cumulative effects at nearby noise sensitive receptors.

17.7.29 The proposed solar farm at Sealand Manor is located in proximity to eastern carriageway works for Dee Bridge Scheme. The solar farm is currently in the early stages; therefore, concurrent construction is not likely, and thus, cumulative effect are not anticipated.

17.7.30 The A55/A494/A548 Flintshire Corridor infrastructure project is currently proposed. Should the Flintshire Corridor project progress to become a concurrent Scheme, cumulative effects associated with construction traffic and diversions are anticipated, particularly if temporary closure of the A548 is required. It is predicted, however, that the construction of the project is unlikely to commence until after the Dee Bridge Scheme has been completed. Therefore, cumulative effects as a result of construction and diversions are considered unlikely. For operational noise, should the Flintshire Corridor project progress, cumulative effects associated with operational noise are not anticipated.

17.7.31 In terms of underwater noise, the Scheme has considered potential cumulative effects arising from utility diversion works that may impact the marine environment. Scottish Power have proposed diversions of high and low voltage cables that require thrust boring under River Dee. The works are likely to coincide with the Scheme; however, no underwater noise is anticipated to arise from this activity. It is expected that the cumulative impact from the Scheme will be unlikely.

17.7.32 Welsh Water propose the diversion of four rising mains be placed below River Dee. The rising mains are expected to be directionally drilled across the river approximately 50m under the riverbed. The diversion of these rising mains does not overlap with the temporary jetty construction and new bridge pier installation works, where most of the underwater noise of the Scheme is generated through riverbed piling. Hence cumulative impacts arising due to the Scheme are considered unlikely.

17.7.33 Cumulative effects that may arise from any concurrent underwater works associated with the thrust boring for the diverted cables and rising mains and the Scheme (Dee Bridge) through airborne sound transmission to human noise sensitive receptors are not anticipated, due to a significant distance between the proposed works and the nearest noise sensitive receptors.

Materials and Waste Chapter 13

17.7.34 Chapter 13 sets out the potential for several impacts with ‘other developments’ included in Matrix 2. Potential ‘cumulative effects’ relate to demand for quarries and other sources of minerals, as well as other finite raw materials, to meet the demands of multiple projects including the Scheme. These receptors could experience the following:

a. The depletion of non-renewable resources.
b. The impact on the national or local demand for materials.

c. Sterilisation of larger areas of land from future mineral extraction either above or below ground[7].

17.7.35 There is potential for similar cumulative effects to arise because of waste generation from multiple projects and demand placed on waste management infrastructure and landfills. Receptors could experience the following;

a. The utilisation and depletion of the remaining local landfill capacity.

b. The occupation of available waste management infrastructure capacity.

17.7.36 During the Scheme construction phase cumulative effects relating to materials and waste may arise in combination with the 'other developments'. The construction of other development could potentially be concurrent with the construction of the Scheme and due to their proximity to the site, could cause cumulative construction impacts. Although there is a low risk that all the schemes on the short-list would be constructed during the same period.

17.7.37 There is the potential that some short-listed schemes could have an adverse impact on the capacity of receiving waste management facilities within the two study areas (as described in Chapter 13). All projects would require materials and generate waste which would require treatment and/or disposal, and this could include third party waste management facilities. There is also a significant requirement for materials, particularly at the construction stage. The timing and duration of the various projects is not known, nor is the scale of demand for materials or the requirement for waste management and landfill understood at this stage.

17.7.38 The scale of the cumulative effects of material use and waste management is likely to be greater than the individual effect of the Scheme alone. The scale of any cumulative effects would be ameliorated by adoption of good practice measures to reduce materials and recycle waste in accordance with all relevant national waste and materials waste reduction plans and targets.

[7] see ES Chapter 6 Geology for further assessment

17.7.39 Based on the existing ES baseline for Materials and Waste (Chapter 13) and on the assumption of a worst-case scenario and the assumption that all the Matrix 2 sites are constructed at the same time, the cumulative effects are not assessed as significant.

17.7.40 The utility companies use statutory powers to put in place any necessary permits for service diversions. These 'other developments' could give rise to cumulative effects because they are likely to be implemented concurrently with the Scheme. It is expected that excavated material arising from the directional drilling and thrust boring required for rising mains and power cables will be brought the surface and will require reuse in the utility scheme, in the proposed Scheme, or taken for disposal to a landfill. The nature of the material is unknown at this stage, although it will be derived the soft materials deposited under the river.

Population and human health Chapter 14

17.7.41 Chapter 14 notes the potential for the Northern Gateway site to be constructed at the same time as the Scheme, but no significant effects identified.

17.7.42 All development proposals will need to demonstrate[8] the extent of any additional or diverted trip generation, together with relevant mitigation and/or financial contributions, likely to improve local transport provision. Cumulative effects are therefore unlikely to be significant.

Climate Chapter 15

17.7.43 Chapter 15 notes that the Scheme is unlikely to result in any negative in-combination effects with other projects and mentions that all projects should be advised to undertake a similar climate risk assessment to identify their project specific and wider climate change risks.

[8] Either with an accompanying Transport Assessment or Transport Statement

Marine Environment Chapter 16

17.7.44 ES Chapter 8 considers the potential cumulative effects. Following a response to the EIA Scoping request, NRW have raised concerns that there could be in-combination effects on the marine environment, in consequence of the Scheme with any individual project or any combination of the three projects at Port of Mostyn. These include the Port of Mostyn Extension, the three-year programme of dredging and the tidal barrage extending from the port to Point of Ayr. Specific concerns are the construction effects on the river channel and benthic habitat, the effects of vibration and noise from piling operations, and an adverse effect on the migration of fish species along the river channel. There is also potential for disturbance of sea birds during construction. The in-combination effects are negligible due to the separation of the projects from the Scheme, but also because the relatively short duration of bridge construction in comparison with that of three years of dredging, piling for the quay extension or construction of the barrage. No significant cumulative effects are noted.

Summary of in-combination effects

17.7.45 The potential for any of the identified short-listed sites to generate cumulative effects with the Scheme, would not be significant within the zone of influence. Several assessments have highlighted the potential for the proposed Flintshire Corridor Red Route to cause in-combination impacts, dependent on its status and progress.

17.7.46 Overall, other developments are sufficiently distant and represent a scale of change that would affect different receptors within the adjoining areas and so would not result in overlapping effects. Furthermore, the effects would not occur at the same time or would not represent a significant impact, as defined by this CEA.

17.8 Mitigation and monitoring

17.8.1 The Construction Environmental Management Plan (see ES Chapter 18) sets out monitoring to be conducted during the construction and management of the Scheme.

17.8.2 The potential for projects to take place concurrently and so place a burden on local and regional supply chains and disposal facilities is assessed as not being significant at this current stage. Measures should be considered to avoid the potential for cumulative effect to increase in significance and so become a key decision-making issue. Therefore, the CEMP should include a reference regarding sustainable sourcing of materials and recycling as a first priority.

17.8.3 No other mitigation or monitoring specifically for cumulative effects for interrelationships or in-combination effects would be necessary.

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[i] [1] An updated list of potential 'other developments' which focused primarily on 'major' applications, from the previous 2018 baseline up to December 2022, identified just under 200 planning application references as provided by the host Local Planning Authority, Flintshire County Council. All the planning references were subsequently reviewed and a total of twenty -seven sites considered to represent a draft 'long list' of development sites in connection with this Scheme CEA. Ongoing consultation the Local Planning Authority included a copy of the draft 'long list' of twenty- seven sites and the resulting final 'long list' and refined 'short list' of sites. A further review in 2025 modified the long list by removing some projects and adding others.

Llywodraeth Cymru / Welsh Government

A494 RIVER DEE BRIDGE REPLACEMENT SCHEME

Environmental Statement

Volume 1: Technical Assessment Report

Chapter 18: Environmental management

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18. Environmental Management

18.1 Introduction

18.1.1 This chapter explains the role of Environmental Management and the purpose of the Environmental Management Plan (EMP).

18.1.2 DMRB LA120 Rev 1 Environmental Management Plans requires an EMP to be prepared for all projects, including for the management and operation of the existing network. This chapter provides an explanation of what is required and why. LA120 explains the purpose of the EMP as being to '*provide clear and concise information which states how the mitigation and management of environmental effects will be delivered and maintained'*.

18.1.3 The assessments reported in the topic chapters of this Environmental Statement (ES) have identified:

a) Potentially significant effects associated with the Scheme.

b) Strategies as to how these can be avoided, reduced or remedied.

c) Requirements for environmental monitoring and further surveys.

d) The need to work in a manner that is compliant with legislation.

18.1.4 The EMP establishes a mechanism to link the commitments and obligations made in the ES to the activities undertaken during construction and operation of the Scheme to manage environmental effects identified within the environmental assessment. As the construction and operation proceeds, the results of monitoring shall be used to update the EMP.

18.2 The EMP document set

18.2.1 Table 2.2 in DMRB LA120, copied to Table 18.1. sets out the three iterations of the EMP.

Table 18-1 Delivery schedule and updates of the EMP

Project stage	EML Iteration	Action
Design	First iteration of EMP (formerly outline EMP) produced during the design stage for the preferred option.	Produced
Construction (refined for the consented project	Second iteration of EMP (formerly construction EMP) refined during the construction stage for the consented project, in advance of construction	Refined
End of construction	Third iteration of EMP (formerly handover EMP) building on the construction EMP refined at the end of the construction stage to support future management and operation.	Refined

Design and draft construction EMP

18.2.2 The first iteration of the EMP was developed during the design stage and preparation of the ES. With publication of the ES the EMP becomes a draft of the Construction EMP (second iteration), provided in Appendix 18A. The Contractor will adopt the draft Construction EMP and incorporate it into their own Construction Environmental Management Plan for the Scheme, which will be managed and audited under the Contractor's established Environmental Management System (EMS).

18.2.3 The EMP must include several elements normally referred to as Management Plans and Risk Assessment, which should be prepared to ensure that environmental risks and commitments associated with the construction of the Scheme are identified, assessed understood and actioned A management plan might, for example, cover a specific concern such as the protection of habitat, or a specific construction task such as pouring concrete to avoid pollution.

Register of Environmental Actions and Commitments (REAC)

18.2.4 Alongside the EMP, a Design iteration of a Register of Environmental Actions and Commitments (REAC) has been prepared, and a draft Construction REAC is

provided in the form of a Schedule in Appendix 18B. Further information about this document and its application are set out in Section 18.8.

Environment Inspection, Service & Maintenance Manual (IS&M)

18.2.5 A requirement for Welsh Trunk Road projects is an IS&M. A draft of this document is provided in Appendix 18C.

The Environmental masterplan

18.2.6 The Environmental Masterplan, shows the spatial arrangement of the scheme and related environmental matters, is included as a set of figures in the ES Volume 2 Section 2. Further information about this document and its application are set out in Section 18.9.

Definitions

18.2.7 The following terms and abbreviations are used in this chapter:

EMS	Environmental Management System *(refer to section 18.4)*	A framework set up within an organisation to manage and control the environmental impact of their activities. The EMS is normally managed and updated by a dedicated Environmental Manager. The EMS sets out the organisation's policies, procedures, and processes to monitor and improve environmental performance and to meet the requirements of regulations and good practice.
EMP	Environmental Management Plan	A strategy set up or adopted to work within an organisation's EMS to support an organisation in managing and controlling environmental impacts on a specific project.
CEMP	Construction Environmental Management Plan	A construction environmental management plan is a live document that outlines how a construction project will avoid, minimize or mitigate environmental impacts.
EAR	Environmental Assessment Report	Reports prepared by suitably competent specialists setting out the findings of environmental assessments and surveys. These are included in the ES as chapters and supporting appendices.

REAC Register of Environmental Actions and Commitments	A document in a tabular form which includes all commitments and actions required for the scheme to be completed through detailed design, construction and aftercare. The live version is in Excel format which can be adopted by the contractor and updated as the scheme progresses, and the various actions and commitments are commenced and completed.
Environmental Masterplan	A set of plans which show the requirements and layout of the detailed design and environmental mitigation and enhancements.
Design (Preconstruction)	All activity that is carried out before construction of the Scheme commences on site. Normally this includes surveys and consultations, preliminary design, cost estimates, environmental impact assessment, completion of any permitting/consenting procedures, such as planning permission, and appointment of a contractor(s).
Construction	The implementation of a permitted scheme during which the site is prepared for construction activity and then construction works are completed.
Maintenance (end of construction)	Once the contractor has reached Practical Completion of the hard engineering elements of the Scheme, that part will be looked after by the contractor for a given period, normally 12 months.
Aftercare (end of construction)	Maintenance of environmental measures within the Scheme is normally carried out by the contractor for a period of 3 to 5 years, for example, to ensure successful establishment of vegetation and management of new and existing habitats to serve protected species.
Handover	On completion of Aftercare the contractor's responsibilities are completed and all relevant information about the scheme is handed over to the organisation responsible for long term maintenance.
Risk	The probability of an adverse impact on the environment as a result of construction activity. Risk calculation normally takes account of several factors, including the likely scale of impact if it were to occur.

18.3 Construction Strategy

18.3.1 Details of the construction sequence of activities to be carried out during the construction period, and their duration, are described in Chapter 2. The broad construction approach to the Scheme is set out in Section 2.11. The construction

programme would be finalised by the main contractor in advance of the works, considering any environmental programming constraints. The duration of the works is currently estimated to require a construction period of 30 months but there are expected to be service diversions which the future contractor may choose to have carried out in advance of the main construction contract.

18.4 Roles and Responsibilities

18.4.1 For the environmental team to be effective in the implementation of a Welsh Trunk Road project, some key roles require experienced staff who will need to work across organisational boundaries to ensure continuity of knowledge and a cooperative and productive approach. The various roles with environmental responsibilities are described in the following paragraphs.

Environmental Manager

18.4.2 The role of Environmental Manager is one taken by the main contractor's own staff. He will be responsible for the internal workings of the EMS. The Environmental Manager will audit the internal systems and plans.

Project Manager

18.4.3 The Contractor's Project Manager will be responsible for developing the EMP for the project and this can sometimes form part of a larger Project Management Plan.

Environmental Coordinator (ECO)

18.4.4 The ECO will be an experienced Chartered Member of an appropriate environmental profession. Their role is to work alongside the Project Manager and Environmental Manager to ensure that the REAC, ES and other key environmental documents are fully taken into consideration during the development of the detailed design and during construction. The ECO will oversee the Environmental Compliance Process for each Key Stage.

18.4.5 The ECO will identify works that are likely to have a significant environmental impact, taking into consideration the findings of the EIA, and advise the Contractor how to avoid adverse impacts. If adverse impacts occur, the ECO can assist the

contractor's team to identify remedial measures. If necessary, the ECO will identify activities that should only proceed once adequate measures Are agreed and are in place for environmental protection. As works progress the ECO will review the Contractor's environmental performance against the commitments, objectives and targets / key performance indicators in the Construction EMP.

18.4.6 To assist in this, the Construction EMP will contain procedures for checking, auditing and corrective action. These procedures will continue to be implemented and updated as required through the construction and aftercare period.

Environmental Clerk of Works (ECoW)

18.4.7 The ECoW is also an experienced professional with a competency in environmental management, construction and environmental surveys. The ECoW will assist the ECO by overseeing the implementation of environmental mitigation and compliance with environmental management systems and plans.

18.4.8 The ECoW would be responsible for:

a) Completing the site inspection pro forma for Surface Water Monitoring and Protected Species Inspection;

b) Delivering method statement / risk assessment briefings to subcontractors / operatives;

c) Ensuring that all work is stopped in the event of discovery of protected species;

18.4.9 The ECoW role will ensure environmental mitigation is implemented by contractors on a day-to-day basis with any design alterations being assisted by environmental specialists.

18.4.10 Both the ECO and ECoW will work with the Contractor's Environmental Manager to apply the Construction EMP through the company's EMS.

18.5 Environmental Management System

18.5.1 A Contractor will be appointed by the Welsh Government to construct the Scheme. Contractors will be required to publish their Environmental Policy, which is a

declaration of intent to ensure that all their projects are effectively managed, environmental impacts are minimised and the operation and environmental management of construction, procurement, energy use and waste management activities are subject to continual improvement. Within the Environmental Policy, the need to develop and maintain an EMS in compliance with ISO 14001 and ISO 14004 is recognised.

The contents of the EMS

18.5.2 The EMS will be a framework for:

a) Setting and reviewing objectives and targets.

b) A monitoring and review process that audits and reports on compliance.

c) The basis for the future operation and maintenance of the completed Scheme.

18.5.3 Within the framework there will be the contractors:

a) Commitments to continual improvement.

b) Sustainable construction objectives.

c) Prevention of pollution and waste.

d) Compliance with legislation and requirements of Statutory Environmental Bodies.

18.6 Contractor's Construction EMP

18.6.1 The Contractor will prepare a plan of work which is the master document that is specific to the project and the site to guide all work, including that undertaken by sub-contractors.

18.6.2 To aid the tenderers during the procurement process and the successful contractor during site mobilisation, the draft Construction EMP, REAC and Environmental Masterplan is produced by the team who have developed Scheme to ensure continuity of environmental knowledge is sustained between each stage of the project. How the EMP is used to maintain continuity of information is illustrated in Table 18.2.

Table 18-2 Sequential Development of the EMP

Key Stage	Description	Status of EMP	Responsibility
0	Shaping of strategy	None	Welsh Government
1	Identification and selection of options		
2			
3	Preliminary design	Design EMP	Designer
4	Statutory procedures and powers		
5 & 6	Preparation, construction and aftercare	Construction EMP (including aftercare)	Contractor
6 & 7	**Handover** Operation and maintenance	Handover Environmental Management Plan (HEMP)	Contractor Maintaining Agent

18.6.3 While the contractor is preparing to commence construction the Project Manager and Environmental Manager will adopt, refine and expand the draft Construction EMP into a 'live' version that contains current environmental management plans, method statements, permits, relevant licences, certificates, health & safety plans, Register of Environmental Actions and Commitments (REAC) and any other relevant documentation the site environmental team require in order to manage the site effectively.

18.6.4 The live Construction EMP will:

a) Identify the key staff structures and responsibilities associated with the delivery of the project and environmental control and communication and training requirements as necessary.

b) Alert the Contractor's site personnel, and those of their sub-Contractors and suppliers, to the potential adverse consequences of construction activity, the significance of actual or potential environmental impacts, and the need to comply with the EMS.

c) Set out applicable good practice, statutory guidance.

d) Personnel roles and responsibilities in meeting the requirements of the EMS, including remedial and emergency procedures;

e) The potential consequences of departure from operating procedures; and

f) Provide a framework for setting and reviewing objectives for sustainable construction, and prevention of pollution and waste.

g) Setting targets and identifying commitments to continual improvement.

h) Record how the requirements of environmental legislation, policy, good practice, regulatory authorities, third parties and project objectives are to be met;

i) Record how commitments, mitigation measures and the environmental design are to be implemented and to gather evidence of completion and the relevant times and dates.

j) Evaluate and record environmental risks and identify how they will be managed during construction and aftercare.

k) Environmental hold points at which construction work shall cease until the ECO agrees that work can proceed.

l) Provide and implement a review, monitoring and audit mechanism to determine effectiveness of, and compliance with, environmental control measures and how any necessary corrective action will take place.

m) Guidance for the future operation and maintenance of the Scheme.

18.6.5 The ECO, supported by the ECoW, would work alongside the Contractor's Project Manager and Environmental Manager to oversee environmental compliance to ensure that commitments to provide mitigation are fulfilled. The ECoW would support the ECO during pre-construction and construction.

18.7 Management Plans and Method Statements

18.7.1 A list of the Management Plans which would be provided by the appointed Contractor are listed in Appendix 18A Table 8.1. It is anticipated that further management plans and method statements would be required as the design of the Scheme progresses.

18.7.2 The Construction EMP would include updates from pre-construction surveys and any modifications arising from commitments made at the Public Inquiry. The document would then be made available for the key stakeholders to comment and would be in place before construction on site commences. During construction, the Construction EMP would be modified as necessary to take account of changes arising during construction works. These modifications could include changes to the design to reflect site conditions, but also because of:

a) New legislation or standards;

b) Unforeseen site conditions, for example the discovery of ground contamination, a previously unknown protected species or archaeological discoveries;

c) Failings in the environmental performance of the Contractor that require improved procedures; or

d) Changes in the design.

18.7.3 Towards the end of the construction phase the EMP would be further refined to provide the essential environmental information needed by the body responsible for the years of aftercare and for the future maintenance and operation of the road and the associated land. This includes landscape and ecological mitigation area management and maintenance. This is set out in the IS&M in Appendix 18C

18.8 Register of Environmental Actions and Commitments (REAC)

18.8.1 A draft REAC has been created and is provided as part of the Design EMP, ES Volume 3, Appendix 18.A. This is a record of the specific environmental actions and commitments to be implemented and managed through all stages of the Scheme. The draft REAC lists commitments made within the ES (principally taken from the mitigation sections of each chapter)

18.8.2 The draft REAC is critical to the success of an EMP and subsequently the environmental performance of a Scheme. The REAC would be implemented and updated through the construction to provide an auditable record of how and when actions are completed and commitments fulfilled.

18.8.3 The draft REAC is provided in a table format to be adopted by the contractor:

Column A	Identification and referencing of the environmental action or commitment.
Column B	Environmental. Aspect & Commitment source
Column C	The objective of the action or commitment.
Column D	Brief description of the environmental action, commitment or mitigation measure.
Column E	Responsibility for the action or commitment.
Column F	Timescale: period when the action or commitment is to be implemented.
Column G	The requirement and timing for monitoring
Column H	The target for completion.

18.8.4 Where it is required that mitigation / action must be monitored to determine success the details of monitoring, success criteria, reporting requirements and trigger level for remedial works would be clearly defined.

18.8.5 The contractor may add additional columns to cover other aspects of the required tasks and to cross reference to minutes, reports, photographs or correspondence that demonstrates how and when the actions or commitments were completed, aftercare implement, and records problems encountered, and any novel or innovative methods used to achieve the results.

18.9 Environmental Masterplan

18.9.1 The environmental mitigation measures incorporated within the design of the Scheme are illustrated on the Environmental Masterplan in Volume 2. The landscape and environmental design proposals for the proposed new section of highway are described in this ES Volume 1 Chapter 9 (Landscape and Visual Effects). The masterplan is updated to reflect each stage in the development of the scheme, with a final ‘as-built’ draft prepared to accurately record the completed works. This is handed over to the maintaining body as information to support their maintenance.

18.9.2 Symbols are used on these plans to represent existing or proposed landscape and environmental features. Each feature is ascribed both an Element and a 'Function' to indicate the physical attributes and the purpose. Sometimes, when appropriate, highway and structural elements are given an environmental function that will guide design and maintenance. Elements and Functions (with their codes drawn from DMRB Volume 10) are defined in Table 18.3 and Table 18.4.

Table 18-3 Masterplan Elements

Term used	Definition
Landscape Element	Landscape features within the highway estate, which can encompass both hard landscape features (i.e. retaining walls, hard surfacing) and elements of the soft estate (i.e. grasslands and woodlands).
Environmental Element	Non-landscape features of the highway estate that have environmental functions, i.e. noise attenuation measures, water quality controls, protected species and legislated elements such as injurious weeds and pests.
Planning Policy Feature	Features pertaining to, or situated near, the highway estate that have a specific designation or land use, i.e. Special Area of Conservation (SAC), Scheduled Monuments, or Listed Building.

Table 18-4 Masterplan Functions

The intended environmental function of features within the highway estate	Code
Visual Screening	EFA
Landscape Integration	EFB
Enhancing Built Environment	EFC
Nature conservation & biodiversity	EFD
Visual amenity	EFE
Heritage	EFF
Auditory amenity	EFG
Water quality	EFH
Highway / land boundary	EFJ
Access	EFK

18.9.3 In addition to a range of proposed features, the masterplans show existing features such as retained vegetation, watercourses and culverts, designated areas, such as Scheduled Monuments, Listed Buildings and Sites of Special Scientific Interest (SSSI).

18.9.4 The Environmental Masterplans include a range of symbols indicating points, linear features and areas. Key to explain these symbols is provided on the environmental masterplan sheets.

18.10 Aftercare, Monitoring and management

18.10.1 There are three tasks that the contractor who builds the proposed Scheme would have to carry out to ensure the proposed mitigation performs the required task: Aftercare; Monitoring and Management.

18.10.2 Proposed mitigation is provided for a purpose and is a commitment made in the Environmental Statement on behalf of the Welsh Government to address a

particular environmental impact. For example, tree planting might be proposed to reduce the visual impact of a view of traffic. When they are planted, trees would not be an effective screen and would need to grow over several years to perform their function properly.

Aftercare

18.10.3 Aftercare is carried out by the Contractor for a period of 3 to 5 years, as required under the contract. This is known as the Aftercare Period. During that time the contractor would carry out tasks such as grass cutting, weed control, replacement of dead plants, watering, repair of fences, cleaning out ditches and repair or replacement of bat boxes or other environmental measures. These tasks would be performed to ensure that the seeding and planting survive and successfully establish as new vegetation. At the end of the aftercare period the contractor would hand over the established and healthily growing landscape and environmental mitigation to the Welsh Government's maintenance agent the North and Mid Wales Trunk Road Agent (NMWTRA). The Environmental Inspection, Service & Maintenance Manual (IS&M) is prepared for handover and is provided alongside the as-built environmental masterplan, REAC and the third iteration (End of Construction) EMP.

18.11 Monitoring

18.11.1 Throughout the aftercare period, and for as long as is necessary to fulfil commitments, the contractor and then NMWTRA would monitor the mitigation measures to:

a) Ensure that mitigation continues to develop properly to meet commitments and functions (e.g. trees should grow as planned).

b) Review whether mitigation will achieve the commitment and function in the required period (e.g. will an area of planting and seeding develop sufficiently quickly to satisfy a requirement of a Protected Species Licence).

c) Check for adverse or changing conditions that might compromise the effectiveness of mitigation (e.g. has a drain become blocked, a fence

become damaged, or trees knocked down or killed by inappropriate use of herbicide).

d) Advise on maintenance interventions that might be required if a failure to meet commitments is identified in a to c above.

18.11.2 Once the mitigation achieves full effectiveness, monitoring would continue to ensure that it continues to perform its proposed function

18.11.3 Monitoring of various kinds ranging from day-to-day observation to sophisticated sampling and analysis is essential to provide information that managers use to make management decisions.

18.12 Management

18.12.1 Once established, the scheme of mitigation would continue to perform its function and satisfy commitments made in the ES until circumstances change. Changing conditions can be predictable or unexpected and they can occur slowly or rapidly. For example, a hedge will continue to grow but will need trimming regularly to ensure it remains stockproof; a plantation will grow for 15 to 20 years before it will need to be thinned, coppiced or underplanted to ensure it remains a health and effective visual screen. A fire could destroy a coniferous plantation within hours, while a plant disease could kill only one species in a plantation. Completing routine annual maintenance, guiding long term change and dealing with occasional unexpected incidents is the process of management.

18.13 Aftercare monitoring and handover

18.13.1 During the contractor's aftercare period regular visits would be undertaken to monitor the performance of the mitigation. Reports would be prepared for the Project Manager giving the results of each visit, any requirements for additional maintenance work and indicating how the scheme of mitigation is performing against agreed indicators. An annual report would bring these together at the end of each year of aftercare. At the end of the aftercare period a Handover Environmental Design Performance Report (HEDPR) would be prepared. The HEDPR will accompany the Handover Environmental Management Plan to assist NMWTRA in taking on the long-term maintenance.

18.14 Summary

18.14.1 Environmental management of the Scheme is a continuing process during design, construction, operation and maintenance. The Contractor would implement a scheme-specific EMS and a CEMP.

18.14.2 As identified within this chapter, management plans would be prepared and treated as 'live' documents. These would ensure that design and mitigation measures from the EIA will be implemented on site by the Contractor. The CEMP would identify those responsible for implementing the various management plans. These management plans would complement and inform one another as well as require regular updates and revisions.

18.14.3 The objective of the EMS and the EMP is to mitigate environmental impacts and provide a comprehensive management plan to reduce any unforeseen environmental impacts.

Llywodraeth Cymru / Welsh Government

A494 RIVER DEE BRIDGE REPLACEMENT SCHEME

Environmental Statement

Volume 1: Technical Assessment Report

Chapter 19: Conclusions

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19. Conclusions

19.1 Purpose of EIA

19.1.1 The proposed A494 River Dee Bridge Replacement Scheme requires an Environmental Impact assessment (EIA) because it is of sufficient size to be classed as a 'Relevant Project' that is '*a project for constructing or improving a highway where the area of the completed works together with any area occupied during the period of construction or improvement by requisite apparatus, equipment, machinery, materials, plant, spoil heaps or other such facilities exceeds 1 hectare or where any such area is situated in whole or in part in a sensitive area*'. The Scheme is also classified as being located within a 'sensitive area' due to the replacement bridge crossing the River Dee that is designated as part of the UK National Site Network and is a Site of Special Scientific Interest. The basis for EIA is set out in The Environmental Impact Assessment (Miscellaneous Amendments Relating to Harbours, Highways and Transport) Regulations 2017, which transposes the 2014 Directive and came into force on 5th December 2017.

19.1.2 The EIA has been completed in accordance with an agreed scope and reports on the potential significant environmental impacts of the Scheme. Each aspect chapter describes the measures to avoid, reduce or mitigate these impacts. The following sections of this chapter summarise the likely effects of the Scheme, taking into consideration proposed mitigation.

19.2 Consideration of alternatives

19.2.1 The proposed Scheme has been developed through a process known as WelTAG, which considers and evaluates alternative solutions to identify the optimum way to meet agreed objectives.

19.3 Scheme design and mitigation

19.3.1 The assessment of likely effects of the Scheme considers the layout, design and the construction processes required to build the bridge, and describes measures which would be applied to avoid, offset or mitigate effects on the environment.

Each assessment includes a statement about whether the effects of the Scheme are significant or not. Significant is the term used in EIA to indicate that an effect is of sufficient size to be worthy of attention, normally 'moderate' or greater. A summary of the findings of each assessment is provided in the sections that follow.

19.3.2 The Scheme is described in the ES chapters, but any mitigation measures that can be shown in a plan are shown in the Environmental Masterplan. The ES and the masterplan are supported by the Register of Environmental Actions and Commitments (REAC), which is a schedule that records all mitigation, sets out details of how the measures are to be achieved, and how the results are to be monitored, is included in an appendix to Chapter 18 Environmental Management.

19.4 Geology and Soils

19.4.1 The assessment considers the potential effects of the proposed Scheme on geology and soils. Works during construction of the Scheme could potentially result in the beneficial effect of removing or remediating any areas of contaminated soils. There is also a risk of adverse effects occurring, such as soil deterioration, disturbance of contaminated ground, contamination of watercourses with sediment, loss of good quality agricultural land, pollution of ground and surface water by accidental spills or leaks during construction.

19.4.2 Mitigation of these effects would include protecting vulnerable soils and controlled waters and using good practice measures to avoid spreading contamination and pollution. With these measures applied there will be no significant adverse effects as a result of the proposed development.

19.5 Road Drainage and the Water Environment

19.5.1 This assessment considers the potential effects on the water environment that could occur during construction and operation of the proposed Scheme. The water environment includes surface water features, groundwater bodies, flood risk, abstractions and discharges in the River Dee, and designated sites hydrologically linked to the proposed Scheme. The assessment is supported by a series of studies and specialist assessments.

19.5.2 Mitigation includes a range of measures to reduce the potential risk and adverse effects on water quality and flood risk. Construction works will include the implementation of standard good practice pollution prevention and control. The design of the proposed bridge would minimise disruption to the flow of water in the River Dee and the use of a jack-up barge should eliminate the need for dredging of the river channel. The assessments conclude that with mitigation there would be no significant adverse effect.

Changes to surface water quality

19.5.3 During construction, water quality in watercourses is reduced by any accidental release of suspended solids, heavy metals, fuel, oil and other construction materials. The assessment indicates that with standard good practice construction methods, the temporary impacts on water quality in the River Dee and the Queensferry Drain would have a slight adverse effect, which would not be significant.

Changes to the quality and quantity of groundwater

19.5.4 During construction the risks to groundwater include a localised reduction in groundwater levels from dewatering of excavations, disturbance from piling and an increase in flood risk from impermeable surfaces. Proposed mitigation would include minimising the duration of excavations, avoiding ground compaction, and management of dewatering activity.

19.5.5 The risks to groundwater quantity and quality arise from piling works which could create a route for groundwater to be polluted, including leaching of contaminants from excavations and increased turbidity. However, 34m of impermeable clay layers overly the permeable bedrock and so it is unlikely that water in the bedrock would be affected. Slight temporary, localised adverse effects could arise during construction. These would not be significant.

Changes to geomorphological conditions

19.5.6 Construction works in the river channel and on the riverbanks, including clearance of vegetation, physical disturbance, trafficking of plant and the proposed

alterations to Queensferry Drain, could increase erosion or scouring of riverbanks. With standard construction management techniques to avoid or mitigate these potential impacts on the River Dee, Queensferry Drain and Garden City Drain, the effects are considered likely to be temporary slight adverse and therefore not significant.

Flood risk

19.5.7 Natural Resources Wales (NRW) indicate that the risks of tidal and fluvial flooding lie mostly within the extents of the River Dee and the Queensferry Drain open channel watercourse. Within this extent, the high-risk area is shown to be confined by flood defence embankments, while areas of low and medium flood risk lie within the flat low-lying areas surrounding the Scheme. The future baseline as a result of climate change is anticipated to affect river levels as a result of extreme rainfall events, however, there is considerable uncertainty regarding the magnitude of this change.

19.5.8 Construction activities for all flood risk receptors would result in a sight adverse effect, although the impacts are expected to be mitigated by embedded design measures.

19.5.9 During operation of the Scheme the assessment shows some land uses would be affected by an increase in flood risk. While the effects on transport, and agriculture would not be significant, the assessment identified a significant adverse effect on some residential and commercial areas. Clarification of the required method of flood risk assessment method indicates that a minor or negligible increase in flood risk magnitude is shown as a significant adverse effect.

19.6 Biodiversity

19.6.1 The scope of this assessment includes the potential effects of the proposed Scheme on biodiversity. Marine Biodiversity is addressed separately in Chapter 16 and the conclusions reported here in Section 19.14. The Scheme baseline has been summarised following a programme of biodiversity surveys. An assessment of potential significant effects has been completed with mitigation measures identified. These are summarised in the following paragraphs.

19.6.2 The Scheme includes works within and adjacent to sites which form part of the national site network and other-designated sites and would affect habitats which support protected and notable species including bats, otters, badgers, birds and amphibians.

19.6.3 Construction activities around the River Dee SAC/SSSI, are likely to result in indirect pollution, changes in water quality, sediment disturbance, noise and habitat disturbance. Proposed good practice environmental protection measures and construction methods to be adopted should reduce the risk of pollutants entering the water and reduce the adverse impacts of noise and vibration. With mitigation the effects would not be significant.

19.6.4 Protected and notable species, including great crested newts, badgers, otters, breeding birds, non-breeding birds, and bats, could be adversely affected by construction activities, but these effects would be mitigated through good practice reasonable avoidance measures, including pre-construction species surveys and ecological supervision of the construction site. Protected species facing habitat loss or disturbance would benefit from habitat creation and reinstatement measures, but this would not be a significant effect.

19.6.5 Great crested newts and other amphibians would experience habitat loss as a result of land take for construction of the Scheme. This would be mitigated by protection of retained areas and creation of new habitats.

19.6.6 The residual operational effects on the Dee Estuary, River Dee, and associated habitats due to potential increased toxicity levels from road run-off could have an adverse impact. Mitigation measures, including highway drainage systems and isolation systems for accidental spillages, would mean that these effects would not be significant during the operation of the road.

19.6.7 Over time, replacement planting would establish and provide continued connectivity and habitat for a range of species, in line with relevant Acts and policies to retain/create/enhance resilient ecosystems and retain connectivity.

19.7 Landscape and Visual Effects

Landscape effects

19.7.1 This assessment reports on the potential effects of the proposed Scheme on the character and quality of the landscape, and the effects on views from receptors such as residential areas and public spaces within a Zone of Theoretical Visibility (ZTV). The assessment identifies any temporary impacts during construction, on completion, and in the Design Year. These effects could occur as direct physical changes or indirect changes to the landscape, or effects on the amenity of visual receptors in terms of changes in view in the day or at night.

19.7.2 An assessment identified several potential significant effects and suitable mitigation. The effects of the Scheme on surrounding Landscape Character Areas (LCAs) were assessed. Of those, only the River Dee Canal –Saltney Ferry to Wepre Gutter LCA, would experience a significant adverse effect during construction which would arise from a temporary change of land use and reduction of tranquillity. During the year of opening, the effect on the LCA would continue to be significant. By the design year, because of the re-establishment of vegetation to form a visual barrier along the road corridor, the effect on the LCA would no longer be significant.

Visual effects

19.7.3 The number of receptors from which views would be adversely affected by the Scheme would be at its greatest during the construction phase. Construction of the replacement bridge and removal of the existing bridge would be highly noticeable changes and, resulting in some significant adverse effects. These include three representative viewpoints. Receptors in that area would be in close proximity to the proposal. Seven residential groups including 57 dwellings, Ferrybank Farm, Riverside Caravan Park, Drybridge Farm, and houses on Queen Street and Dundas Street) would experience a significant adverse visual effect and a change in visual amenity during construction.

Opening Year effects on views

19.7.4 During Opening Year, only 1 representative viewpoint, Ferrybank Farm, is predicted to experience a significant adverse visual effect. The receptor is in proximity to the Scheme with nothing intervening in the view. Three residential groups, made up of 31 dwellings, including Ferrybank Farm, Riverside Caravan Park, some houses on Claremont Avenue, would experience a significant negative visual effect. This is less than during construction.

Design Year effects on views

19.7.5 By the Design Year, 15 years after completion, it is expected that no representative viewpoints and no residential groups would experience a significant negative visual effect compared with the baseline. Mitigation measures would reduce the significance of visual effect on the seven representative viewpoints and seven residential groups.

19.8 Archaeology and Heritage

19.8.1 An Archaeological Desk-Based Assessment (DBA) has been prepared. This assessment examines the potential effects of the proposed Scheme on historic assets. The baseline includes statutory designated assets including Listed Buildings and Ancient Monuments, Historic Landscapes and Registered Parks and Gardens. The baseline also includes non-designated assets.

19.8.2 Historic assets are distributed throughout the study area. These primarily date from the nineteenth and twentieth centuries. The implementation of the Scheme would result in an adverse effect on several historic assets, arising from physical damage to some and indirect impact on the visual setting of others that would not be physically affected.

19.8.3 Seven designated sites would receive an adverse impact to their setting, but none of these effects would be significant. There would be a significant impact on five non-designated assets identified in this study. These are Aston Quay, Aston Quay Landing Stage IV, Aston Quay Landing Stage III, Aston Quay Landing Stage V and a sluice.

19.8.4 Eleven un-designated assets, features that have either been demolished or located under the embankment of the present A494 road, or are outside the limits of construction would be affected but the effect would not be significant.

19.8.5 Mitigation is proposed including further archaeological investigation of four locations. An archaeological watching brief is proposed, which might lead to further investigation if buried remains are identified.

19.8.6 There are no significant cultural heritage effects that require future archaeological monitoring during the operation of the scheme after construction. Landscape and visual measures will provide mitigation for impacts on the settings of cultural heritage resources in the surrounding study area.

19.9 Air Quality

19.9.1 The assessment identifies that the proposed Scheme has the potential to cause both adverse effects from construction dust and beneficial effects on air quality affecting sensitive human receptors and habitats. These effects would not adversely affect the reported ability of the UK to comply with the legal air quality obligations.

19.9.2 Considering the results presented in the assessment, the Scheme is consistent with national and local planning policy with respect to air quality.

Construction dust

19.9.3 A qualitative assessment of potential dust effects has been carried out including a review of likely dust raising activities and identification of sensitive receptors within 200m of the study area. Potential dust impacts would be suitably controlled using the best practice mitigation measures set out within the CEMP.

Construction traffic

19.9.4 A qualitative assessment of the impacts associated with construction traffic management has also been undertaken and concluded that due to the temporary nature of the measures and low existing pollutant concentrations, there are not

expected to be significant air quality effects at nearby receptors during the construction phase.

Operation of the Scheme

19.9.5 An assessment has been undertaken to assess the impact on human health receptors and air quality during the operation of the Scheme. The existing air quality has been monitored, and the data has been used to estimate the possible impacts on air quality due to changes in traffic associated with the Scheme.

19.9.6 The operation of the Scheme will affect concentrations of nitrogen dioxide and particulates, but any changes that could affect human receptors are expected to be well below UK air quality objectives. The Scheme does not affect the UK's reported ability to comply with the Air Quality Directive in the shortest timescales possible. These predicted effects on air quality are not significant, so no mitigation measures are proposed.

19.9.7 It has been concluded that there will no overall change in air quality impact from operation of the Scheme on designated habitats. The replacement bridge is not expected to change the quantity of road traffic emissions or their impact on ecological receptors, but these impacts would be relocated approximately 40m south-east where habitat critical loads are the same. Therefore, it has been concluded that the changes caused by the Scheme are not significant.

19.10 Noise and Vibration

19.10.1 The Scheme has the potential to give rise to both temporary and permanent noise and vibration impacts that could affect nearby sensitive receptors adjacent to the Scheme and along nearby road links. Consequently, these impacts may generate adverse or beneficial effects at sensitive receptors. There are Noise Priority Areas (NPAs) in proximity to the Scheme, but the assessment has shown that noise effects on these NPAs would be negligible and would not result in a significant change.

19.10.2 During construction there is likely to be a significant but temporary adverse effect during the working day due to construction noise. Receptors anticipated to

experience significant adverse effects are residents of properties on Claremont Avenue, the south-western end of Dundas Street, Queen Street, Drybridge Farm and the Riverside gypsy and traveller's site.

19.10.3 Vibratory compaction associated with proposed pavement works on Riverside Way is predicted to have a temporary significant adverse effect on human receptors located in the north-western extent of the gypsy and traveller's site.

19.10.4 On a precautionary basis, it has been identified that there is potential for vibratory sheet piling and vibratory compaction, to have a significant temporary adverse effect on undesignated heritage assets, in the vicinity of the proposed bridge.

19.10.5 The principle of best practicable means for the control of construction noise will be implemented throughout the construction period. Mitigation measures could include the use of alternative construction methods, programming of works to reduce the duration of activities close to noise sensitive receptors, and the provision of temporary noise barriers. The Contractor would be required to obtain consent for works from Flintshire Council under Section 61 of the Control of Pollution Act 1974. No further specific measures to further reduce noise levels have not been applied in the calculation of construction noise and its effects.

19.10.6 No significant adverse effects on human receptors are anticipated due to construction vibration, or due to the operation of the contractor's compound, satellite compounds or construction traffic.

19.10.7 Numbers 3, 5 and 50 Claremont Avenue have been identified as having a significant beneficial effect resulting from implementation of the Scheme during the night-time. Numbers 3, 5, 7, 48 and 50 Claremont Avenue have been identified as having a significant beneficial effect resulting from implementation of the Scheme during the daytime.

Operation effects

19.10.8 No significant adverse effects due to operation of the Scheme are predicted.

19.11 Material Assets and Waste

19.11.1 The assessment has considered the use of materials and the production of waste during construction of the Scheme, and during the operational phase by examining the provision and use of primary, secondary, recycled and manufactured materials, the generation and management of wastes, and the neutralisation of minerals reserves by land take for the Scheme.

19.11.2 The assessment estimates the volumes of concrete and the weight of steel that will be required to build the Scheme. In the National context these would amount to a small fraction of the available supply. Earthworks would require the importation of fill but where possible any suitable material excavated on site will be re-used as fill.

19.11.3 Measures to reduce the effects of material use and waste generation and its management by the Scheme during the construction phase would be implemented. Because there is synergy between the re-use of materials and the avoidance of waste generation, there is overlap in the mitigation for both aspects.

19.11.4 During construction, the contractor will prioritise the recycling of waste materials and these will be taken to the closest available recycling centre. However, the efficient use of materials imported to the site and the reuse of fill from on-site excavation would not result in a significant beneficial or adverse effect. Where necessary, waste will be removed from site to a permitted facility.

19.11.5 There are mineral reserves in the vicinity of land require for construction. The presence of the River Dee SSSI/SAC would neutralise any commercial exploitation in the future. Therefore, the Scheme would not have a significant effect on these reserves.

19.11.6 The likely significant effects of the proposed Scheme on material assets and waste management are not significant. Therefore, there are no residual significant effects associated with material assets and waste.

19.12 Population and Human Health

19.12.1 The assessment has considered the likely significant effects on the population and on human health that could result from the proposed Scheme. The effects during construction and operation are assessed under the categories of land use, accessibility and human health.

19.12.2 There will be permanent loss of land affecting two businesses located beside the A494 which is a significant adverse effect. A footpath would be closed for a two-year period, and this would constitute a temporary significant effect. Once reopened there would be no impact on the footpath.

19.12.3 A section of the Wales Coast Path, which here follows the bank of the River Dee, would be closed for two years during construction of the Scheme, with a diversion provided during the closure. This temporary impact would also be a significant adverse effect, but the proposed Scheme would create a new shared use cycle route to provide a direct link between the proposed A494 cycle path and footpath Sealand 2 (which forms part of the Wales Coast Path). Enhancements will additionally be made to active travel routes which link to the Wales Coast Path. These proposals would be a significant beneficial effect.

19.12.4 The Scheme construction would have a significant temporary adverse effect on amenity for residents of properties on Claremont Avenue, Dundas Street, Queen Street and Riverside Way. There would be no significant effects during operation of the Scheme.

19.13 Climate

19.13.1 This assessment has considered the effect of the Scheme on climate (i.e. the generation of greenhouse gases (GHGs) during construction, operation and demolition, if that is required. The assessment also addresses the vulnerability of the Scheme to climate change.

19.13.2 The UK and Welsh Governments both declared climate emergencies in 2019, placing a greater focus on reducing GHG emissions. The potential impact of GHGs is assessed against current GHG emissions budgets.

19.13.3 The Climate Change Act 2008 forms part of the UK Government's plan to reduce GHG emissions. The reduction, which is legally binding, is managed by setting carbon budgets to cap the amount of GHG to be emitted in the UK over each five-year period. The impact of the scheme of climate is assessed by calculating the likely effect on achieving the reduction targets of each period. Biogenic carbon is also considered because the change could affect the capacity of the Scheme study area to sequester carbon from the atmosphere.

19.13.4 The GHGs are assessed for the construction phase (embedded carbon of materials, fuel and waste materials); the operation phase (maintenance and road user emissions), and the 'end-of-life' phase, (demolition of the Scheme) at some point in the future when it is no longer required. These phases are expected to take up less than 0.02% of either of the Wales or UK carbon budget targets. This would be an insignificant impact because the magnitude of emissions from the Scheme, would not have a material impact on the ability of the UK and Welsh Government to meet its carbon budgets and therefore would not give rise to a significant effect on climate.

19.13.5 Assessing the vulnerability of the Scheme to climate change involves considering policy, legislation and guidance and the Welsh Government's commitments to enhancing infrastructure standards to improve resilience against climate impact.

19.13.6 Risks associated with climate change have been identified using the present-day and future climate baseline to be of two kinds. These are acute hazards with a sudden onset, such as damage by a storm; and chronic hazards with a slow onset due to cumulative events over time such as deterioration following seasonal weather.

19.13.7 There is potential for climate change to adversely affect the Scheme throughout its operational lifetime. The probability and frequency of any disruption occurring, and the ability for the Scheme to return to a normal function have been considered. With embedded mitigation the vulnerability of the Scheme is not considered to be significant.

19.14 Marine Environment

19.14.1 The Marine Environment assessment addresses the effects of the Scheme on marine ecological receptors including protected or designated sites (for example, the River Dee is a Special Area of Conservation), marine, estuarine and intertidal/littoral habitats' as well as fish, birds and amphibians within a zone of influence. The baseline has been established through surveys and using published data. Biodiversity is addressed separately in Chapter 8 and the conclusions reported here in Section 19.6.

19.14.2 There are several sensitive ecological receptors, including the River Dee and a range of marine species associated with the habitats present. The river is designated as a Site of Special Scientific Interest (SSSI) and, along with Bala Lake is a SAC extending from source to the start of the Dee Estuary Ramsar, SAC and SPA. The Ramsar site lies 1km to the north-west of the Scheme.

19.14.3 The Scheme would have impacts on the marine environment and so mitigation has been considered as part of the proposed design and construction methodology, aiming to reduce potential environmental effects. These measures are standard industry good practice for this type of development that include measures to control pollution and disturbance during construction.

19.14.4 Avoidance, prevention and reduction measures would be applied at appropriate seasons to protect breeding and wintering birds, migratory fish and marine invertebrates. In addition, it is proposed that in compensation for the permanent loss of an area of saltmarsh, replacement habitat is proposed at Greenfield Marsh. In the shadow area of the original bridge, which is to be substantially removed, modifications to the existing bridge revetment would be considered to encourage the natural colonisation of saltmarsh habitat.

19.14.5 The assessment concluded that there would be no significant adverse land use effects on the marine qualifying features of the SAC, SSSI and Ramsar designations associated with the River Dee. With the impact of replacement saltmarsh habitat at Greenfield Marsh taken into consideration there would be a significant beneficial effect.

19.14.6 An adverse effect of construction of the new bridge piers on fish, overwintering birds and breeding birds would not be significant.

19.14.7 Construction noise and vibration associated with piling could have a direct moderately adverse impact on lamprey and salmonid fish species. With mitigation this potentially significant effect would be reduced to not significant. The effects of construction stage lighting on migratory fish, and the disturbance of sediment and the risk of pollution during construction would not be significant.

19.14.8 The operational effects of the Scheme on the SAC and SSSI are considered to be not significant. Overall, the assessment concludes that the construction, operation and maintenance of the Scheme would result in minor residual effects on the marine environment which would not be significant.

19.15 Cumulative Effects

19.15.1 The assessment of cumulative effects covers changes to the environment arising from the Scheme, where multiple impacts could combine to have a significant effect on a particular receptor. This could, for example, be a combination of construction noise and construction dust affecting a particular group of houses. Cumulative effects could also arise from multiple projects occurring in combination. For example, construction of the Scheme and a nearby factory.

19.15.2 Fifty-one development projects located in the surrounding area have been identified as having potential to cause cumulative effects with the Scheme. From a shortlist of seventeen developments, selected for further assessment, seven sites were assessed as being likely to cause cumulative effects with the Scheme. No significant cumulative effects would arise from these.

19.16 Environmental Management

19.16.1 Environmental Management is a means of carrying forward the environmental commitments and data from the ES through to construction and operation of the proposed Scheme. DMRB LA120 explains the purpose of the Environmental Management Plan (EMP) in road construction projects as being to '*provide clear*

and concise information which states how the mitigation and management of environmental effects will be delivered and maintained'.

19.16.2 The mechanism for this transfer of information to the contractor is the EMP. The EMP is a 'live' document that ensures that the contractor is made aware of the need to carry out defined actions and to fulfil agreed commitments and obligations, to manage environmental effects identified within the ES and to complete a programme of monitoring. As the construction and operation proceeds, the results of any environmental monitoring are used to update the EMP during the construction, aftercare, handover and post-handover stages.

19.16.3 The draft of the EMP included as an appendix to Chapter 18 is the Design EMP. This is updated with a second iteration and further details during the construction contract and is known as the Construction EMP (CEMP).

19.16.4 The Design EMP sets out roles and responsibilities of the key construction team members, provides design stage drafts of many of the management plans and further detail set out in ES Appendix 18A. An example might be the Pollution Control and Prevention Plan. The design draft of the Register of Environmental Actions and Commitments (REAC) is provided with the ES. This document is a 'live' schedule setting out individual tasks which must be completed during detailed design, construction, aftercare or operation. The REAC is updated to provide an audit trail with information such as reports, minutes of meetings, photographs, monitoring records, daily site records, as required to demonstrate effective progression and completion of each task.

19.16.5 The Design EMP will be handed over to the contractor for implementation, ensuring an effective handover of information.

19.17 Summary

19.17.1 The ES reports on a range of assessment aspects required in the agreed scope. The assessments within Chapter 6 Geology and Soils; Chapter 8 Biodiversity; Chapter 11 Air Quality; Chapter 13: Materials and Waste, and Chapter 15: Climate indicate that no significant effects are predicted. Chapter 17 Cumulative Effects also indicates no significant in-combination or cumulative effects.

19.17.2 The other assessments, Chapter 7 Drainage and the Water Environment; Chapter 9 Landscape and Visual Impact; Chapter 10 Archaeology and Heritage; Chapter 12 Noise and Vibration; Chapter 14 Population and Human Health; and Chapter 16 Marine Environment; have assessed one or more significant effects. Those aspects where a significant effect is predicted are listed below.

Environmental Aspect (Chapter Number and Heading)		**Possible significant effects**
7	Water and drainage	Likely significant flood risk effect for residential and commercial properties within a limited area.
9	Landscape and visual effects	Significant adverse effect on the landscape character area in which the River Dee sits due to a change of land use during construction. The visual effects of construction would also be a significant temporary adverse effect. During operation of the bridge there would be significantly adverse effects on three representative viewpoints with up to 57 dwellings likely to experience a significant adverse visual effect. These receptors are in proximity to the Scheme and would see significant changes in visual amenity. During the Opening Year, the benefits of re-established vegetation cover, would reduce the significant adverse visual effects to the Representative Viewpoint at Ferrybank Farm and 31 dwellings.
10	Heritage and archaeology	The non-designated historic asset of Aston Quay Landing Stage III would experience a significant adverse effect.

12	Noise and vibration	Significant temporary vibration effect from road pavement works on Riverside Way. Significant temporary construction noise effects during the daytime on residential properties on Claremont Avenue, Dundas Street, Queen Street, Drybridge Street and the gypsy traveller's site.
14	Population and human health	A significant temporary adverse effect on the health of some residential properties on Claremont Avenue, Dundas Street, Queen Street and Riverside Way during construction. A significant adverse effect on two businesses located beside the A494. The temporary closure of a footpath and diversion of the Wales Coastal Path would be a significant temporary adverse effect. During operation the proposed footpath/cycleway enhancements would be a significant beneficial effect.
16	Marine Environment	A significant beneficial effect arising from the creation of additional saltmarsh habitat.